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SOLID WASTE MANAGEMENT PLAN: REPORT ON THE STATE OF WISCONSIN

Wisconsin Department of Natural Resources
Madison, Wisconsin

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SOLID WASTE MANAGEMENT PLAN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
Box 450 Madison, Wisconsin 53701
1974
DIVISION OF ENVIRONMENTAL STANDARDS
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• Introduction

This report is presented in fulfillment of U. S. Environmental Protection Agency Solid Waste Planning Grant L005050. Its purpose is twofold:

1. To provide a status report to the citizens of the State of Wisconsin on Solid Waste Management programs carried out by state government in accordance with legislative direction.
2. To review existing solid waste management programs, recommend new programs and changes in existing programs, and examine some possible legislative alternatives for continuing to meet future solid waste management needs of the citizens of the state.

This report addresses planning and program activities carried on in the state in an on-going effort to establish efficient, economical, environmentally acceptable solid waste management.

Many types of planning processes exist. This report deals primarily with two–program planning and long-range planning. Program planning is specific and is directed at finding ways to most efficiently accomplish the goals, objectives, and policies established by the state Legislature for solid waste management in Wisconsin. Through Chapter 83, Laws of 1967, the Legislature established basic goals, objectives, and policies to protect the environment and directed the Department of Natural Resources to plan and implement necessary programs. In Chapter 130, Laws of 1971, the Legislature established additional solid waste goals, objectives, and policies related to developing county solid waste management plans and systems and gave new program responsibilities to the Departments of Natural Resources and Local Affairs and Development.

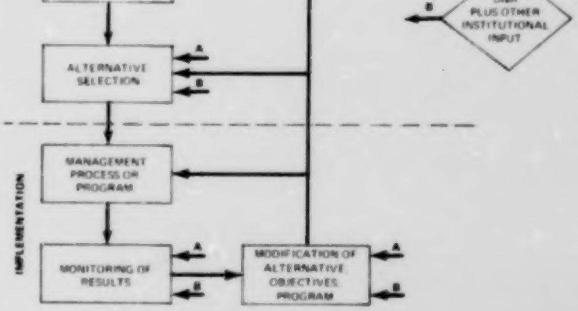
These Laws and others discussed in Chapter 1 of this report provide the basis for program planning and implementation. Figure 1.1 indicates the general steps that are undertaken in the program planning and implementation process. This process is a dynamic, on-going process which requires continual input, monitoring, and program modifications. It responds to changing conditions and needs.

In Wisconsin this process has been used to develop effective solid waste management programs. The Legislature, in establishing program goals, objectives, and policies, responded to input from the public, municipal organizations, state agencies, private industry, and others. Data collection and analysis, presented in Chapters 4 through 8 of this report, have provided pertinent information for program planning, implementation and modification. Development and selection of program alternatives, program implementation, and monitoring of results is discussed in Chapter 2.

Chapter 3 discusses alternatives for modifying programs to meet new goals, objectives, and policies based on changing needs. Evaluation of alternatives described in Chapter 3 can be considered an important part of long-range planning. Decisions to adopt any of these alternatives must be made by the Legislature based on a variety of inputs. Recently receiving legislative consideration is a major statewide recycling act. If this proposal is authorized, the planning process will be used to implement additional programs to meet goals, objectives and policies established by the Legislature. By this means program planning and long-range planning are combined in a dynamic process which can continually respond to changing solid waste management needs in the state.

FIGURE 1.1

The Planning and Implementation Process


DATA COLLECTION AND ANALYSIS
ESTABLISH GOALS AND OBJECTIVES
A
B
ALTERNATIVES ENUMERATION
PUBLIC INPUT
A
PLANNING
TRADE OFFS ANALYSIS
DNR PLUS OTHER INSTITUTIONAL INPUT
B
ALTERNATIVE SELECTION
A
B
IMPLEMENTATION
MANAGEMENT PROCESS OR PROGRAM
MONITORING OF RESULTS
A
B
MODIFICATION OF ALTERNATIVE OBJECTIVES PROGRAM
A
B

· Part One

●●●●● CHAPTER 1 ● GOALS, OBJECTIVES, POLICIES, AND PROGRAMS FOR SOLID WASTE MANAGEMENT IN WISCONSIN

This chapter, after giving a brief background on federal programs in solid waste management, describes the existing Wisconsin Solid Waste Management Plan established by state statutes.

Early federal programs in air and water pollution control revealed the interrelationships between air and water quality and the management of solid waste. It became evident that if air quality is to be improved, open burning in dumps and salvage yards must be controlled. If water quality is to be enhanced, solid waste must not be placed in or near wetlands, shorelands or floodplains, or be allowed to contaminate groundwater.

Reports such as "Restoring the Quality of Our Environment," prepared by the Environmental Pollution Panel President's Science Advisory Committee, and "Waste Management and Control," prepared by the Committee on Pollution (NES-NRC), pointed out the need for attacking the solid waste problem if air and water pollution problems are to be solved. These reports also stressed that solid waste presents a pollution problem in its own right.

On the basis of such evidence, Congress passed Public Law 89-272, commonly called the Solid Waste Disposal Act of 1965. This action acknowledged that solid waste was a national problem and assigned to the states the responsibility for establishing standards and regulating solid waste management. The Federal Act also provided funds for state solid waste planning and for demonstration and research programs and established education, information, and technical assistance services.

In 1967 the Wisconsin Legislature passed the first comprehensive state law dealing with solid waste. This law, which established the initial Solid Waste Management Plan, focused primarily on environmental protection aspects of solid waste and air pollution control; it assigned solid waste management and air pollution control responsibilities to the Department of Natural Resources. Wisconsin's initial plan for solid waste management was established by Chapter 83, Laws of 1967. The core of the solid waste legislation is contained in Wisconsin Statutes 144.43 and 144.44.

The goal established by the Legislature for solid waste management in Wisconsin was:

- enhance the quality, management and protection of the state's air, water and land resources.

This legislation also established program objectives for the Department of Natural Resources:

- establish minimum standards for the location, design, construction, sanitation, operation and maintenance of solid waste disposal sites and facilities by January 1, 1969.
- establish an annual licensing program for solid waste disposal sites and facilities, so that conformance with the minimum standards is insured, by January 1, 1969.

So that the Department would have guidelines on which to base the program the legislature also included four policy statements:

- protect wetlands, shorelands and floodplains.
- encourage voluntary cooperation.
- encourage local units of government on an operational basis to handle their own solid waste management.
- encourage solid waste management on a regional basis.

Specific details of the program, as stated or implied in the legislation were:

- promulgate minimum standards
- hold public hearings on standards
- license sites
- enforce standards
- issue orders
- collect and diseminate solid waste information
- provide technical assistance
- coordinate air and solid waste programs
- undertake research

The initial Solid Waste Management Plan was altered in 1971 when the legislature gave counties authority to establish solid waste management plans and systems alone or jointly with other counties, cities, villages or towns. This authority, as well as provisions for plan assistance and review by the Department of Local Affairs and Development, was created in Chapter 130, Laws of 1971.

Once again, the goals of the legislature were clear:

- encourage regional solid waste management.
- encourage a planned approach to solid waste management.

The Legislature also established policy guidelines and objectives for implementation of the county solid waste laws:

- assist counties in providing the leadership for cooperative solid waste management systems.
- obtain solid waste management plans, which would include all municipalities in the state.
- assure uniformity of plan procedures and completeness of plans.
- assure conformance of planned systems with the Wisconsin Solid Waste Management Rules.

Program responsibilities were assigned to the Department of Local Affairs and Development (DLAD), and the Department of Natural Resources (DNR). DLAD is given three major responsibilities:

- draft administrative rules regulating preparation of county solid waste management plans.
- review on-going and completed regional plans.
- forward plans together with review comments to DNR for final review and approval.

DNR responsibilities are twofold:

- insure that plans are sound and conform with DLAD planning rules.
- insure that planned systems comply with the Wisconsin Solid Waste Management Rules.

Also implied in the legislation was the responsibility for both the DLAD and DNR to provide technical assistance and education to counties for planning and implementing regional systems.

The county enabling, legislation was quite broad in granting planning and implementation authority to county governments. These broad county powers are important because recent State and national studies have indicated that an areawide approach to solid waste management may permit more efficient operations and result in possible reduction of costs.

Several other Wisconsin statutes delegate authority for dealing with solid waste or provide procedures to deal with the specific waste problems such as abandoned auto hulks. To allow county system operation by a body other than the county board, Chapter 105, Laws of 1973 amended the enabling legislation to allow counties under 500,000 population to establish solid waste management systems operated by a "solid waste management board." This board is empowered to hire a manager for the system and to exercise the same powers as those granted the county board.

Chapter 276, Laws of 1971, outlines procedures permitting metropolitan sewerage districts to engage in solid waste management if county boards with jurisdiction over areas to be served by the district have requested or approved district involvement. Metropolitan sewerage districts are authorized to use their bonding and taxing powers to acquire, construct and operate solid waste management facilities. But district acquisition of land by eminent domain is not permitted.

Chapter 131, Laws of 1971, declares that any vehicle left unattended on public property, on a highway or on private property without permission of the owner, for the period provided in local ordinances or for more than 48 hours in a first class city, is deemed abandoned and constitutes a public nuisance. Municipalities may enact ordinances governing removal and disposal of abandoned automobiles, which may be junked if the costs of impoundment would exceed the value of the vehicle. If the value is over $100 the owner must be given notice to enable him to reclaim the vehicle, and he is responsible for all costs involved unless the vehicle was stolen.

In 1972 the state legislature created two statutes, modeled after the National Environmental Policy Act, providing for preparation of environmental impact statements. The Wisconsin Environmental Policy Act (State Statute 1.11) provides that all state agencies are to prepare detailed environmental impact statements on any "major actions significantly affecting the quality of the human environment." The purposes of this act are to declare a policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; and to enrich the understanding of the important ecological systems and natural resources.

State Statute 23.11 (5) states that, "the department (DNR) may require an applicant for a permit or statutory approval which the department, by order, may grant, to submit an environmental impact report (EIR) if the area affected exceeds 40 acres or the estimated cost of the project exceeds $25,000."

Recently promulgated guidelines modify and expand EIS procedures in an effort to insure public input at an earlier stage.

SUMMARY

These laws form the basic State Solid Waste Management Plan. The goals, objectives and policies of the existing plan as established by the Wisconsin Legislature are:

1. Enhance the quality, management and protection of the state's air, water, and land resources.
2. Establish by 1969 minimum standards for the location, design, construction, sanitation, operation and maintenance of solid waste disposal sites and facilities.
3. Establish by 1969 an annual licensing program for solid waste disposal sites and facilities, so that conformance with the minimum standards is insured.
4. Encourage voluntary cooperation in meeting standards.
5. Protect wetlands, shorelands and floodplains.
6. Encourage local units of government on an operational basis to handle their own solid waste management.
7. Encourage regional solid waste management.
8. Encourage a planned approach to solid waste management.
9. Assist counties in providing leadership for cooperative solid waste management systems.
10. Obtain solid waste management plans from counties which would cover all municipalities in the state.
11. Assure uniformity of plan procedures and completeness of plans and assure conformance of planned systems with the Wisconsin Solid Waste Management Rules.
12. Adhere to a policy which will encourage productive and enjoyable harmony between man and his environment, prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, and enrich the understanding of the important ecological systems and natural resources.

Chapter 2 discusses on-going program activities carried out to meet the goals, objectives, and policies of the legislative plan and examines program needs and future activities.

CHAPTER 2 • IMPLEMENTATION OF WISCONSIN SOLID WASTE MANAGEMENT PLAN AND PROGRAMS

This chapter discusses programs and activities carried out by state and local government in accordance with the Wisconsin Solid Waste Management Plan. Since the Legislature assigned primary program responsibility to the Department of Natural Resources, the emphasis of this discussion is on department programs. The chapter reviews past and ongoing programs, summarizes program deficiencies and needs, and examines future programs and activities. While each program area is considered chronologically, actual program activities have, in most cases, occurred simultaneously to achieve objectives of the state plan.

STANDARDS AND LICENSING

In accord with Chapter 83, Laws of 1967, a major state level program has included the setting of solid waste management standards and the development of a licensing procedure for all solid waste disposal operations. Aided by a technical advisory committee representing state, municipal, educational and business interests, the Department of Natural Resources prepared solid waste management standards. These proposed standards included provisions for all land disposal operations in the state to be conducted as sanitary landfills (i.e., with no open burning and with daily earth covering of all solid waste). However, following a series of public hearings and informational meetings in nine cities it became apparent that immediate upgrading of operations would create severe hardships for small communities. For this reason the original standards which were adopted on March 12, 1969, included a "three-tier" set of operating requirements and exemption provisions based primarily on population served by the operation. For those sites serving fewer than 1,000 people, the standards included operating exemptions which allowed supervised open burning and semi-annual earth covering of solid waste. Those sites serving between 1,000 and 2,500 people were allowed supervised open burning and monthly covering. Sites serving more than 2,500 people were required to be operated as full sanitary landfills, with no open burning and with daily covering of all waste. For some of these large operations exemptions were provided for limited and supervised burning of clean wood wastes in areas separate from the active fill area.

The overall objective of the initial standards was to provide sanitary, environmentally acceptable, and nuisance-free solid waste disposal in ways that were both physically and economically feasible. A statewide annual licensing program was developed to insure that disposal operations met minimum standards.

The Department of Natural Resources faced a difficult task during the first two years of the licensing program. Hundreds of disposal sites in the state had to be located and inspected prior to licensing, and operators had to be informed of the new requirements.

During inspections that first year the Department of Natural Resources found very few sites that met the new standards. Information gathered indicated that only seven percent met minimum standards. Three percent lacked the potential for reasonable improvement. Conditional licenses were issued to 90 percent of Wisconsin's disposal sites, giving the operators a reasonable time in which to budget for and make necessary improvements.

The two-year interim for gradual compliance with the standards was completed when the Natural Resources Board resolved that no more conditional licenses would be issued after June 30, 1971. With increased district staff, every site was inspected twice in 1971, and photographic "before-and-after" records were made.

The first inspections revealed that most sites had not been adequately improved during the conditional license period. During these inspections, instructions on improving the operations were given to site operators and local officials. The second inspections, made later in the year, showed substantial improvements in the majority of sites. Approximately 95 percent then met license requirements.

Disposal site licensing information and waste management data were computerized in 1971. This increased efficiency and made the data more accessible for planning and other purposes.

In the spring of 1973, the Department of Natural Resources discussed proposed revisions and expansion of the standards to include recent waste management technology and to reflect increased environmental awareness. The revised standards became the Wisconsin Solid Waste Management Rules.

The revised rules were discussed at six public hearings throughout Wisconsin; they became effective on July 1, 1973. In addition to including recent technological developments, the most significant changes in the "Wisconsin Solid Waste Management Rules" are those pertaining to land disposal operations. Operating exemptions for open burning are to be terminated by October 1, 1975, except for the supervised burning of clean wood wastes at sites serving less than 2,500 people. After October 1, 1975, earth covering of solid waste will be required at least once a month, except during winter, for all sites serving less than 2,500 people. Future licensing activities will be based on these and other provisions of the Wisconsin Solid Waste Management Rules.

ENFORCEMENT

Licensing has been coupled with enforcement to insure compliance with the solid waste management rules. Three options for licensing and enforcement have been available:

1. If the site is properly located and operated, it is licensed. The annual license specifies the operating requirements as well as any exemptions that apply.
2. If the site does not meet location requirements or violates operating requirements, an order for improvement can be issued. Such an order typically specifies necessary improvements and sets a limit for making them. If the site is improperly located, a time schedule for total abandonment is established.
3. If site corrections specified in the order are not made within the designated time, the order can be referred

TABLE 2.1

Comparison of Solid Waste Management Licensing and Enforcement Actions for 1971-72, 1972-73, and 1973-74

	Licensing Period					
Category	1971-72	% of Total State Pop.	1972-73	% of Total State Pop.	1973-74	% of Total State Pop.
LICENSING						
1. Land Disposal Operations Population Served By:						
a) licensed sanitary landfills	2,419,344	53.4	2,832,967	62.0	3,435,479	74.8
b) licensed modified landfills and open dumps	717,869	15.8	552,492	12.1	505,629	11.0
c) disposal sites under orders to upgrade to sanitary landfill status	215,463	4.8	249,283	5.4	105,140	2.3
d) disposal sites under orders to close	79,220	1.7	195,139	4.3	181,508	3.9
e) total number of known sites	1,338	–	1,429	–	1,482	–
2. Other Operations Population Served By:						
a) licensed incinerators					3,000	<1.0
b) incinerators under orders to upgrade or close					219,552	4.8
c) total number of municipal incinerators					13	–
d) number of licensed collection and transportation services					586	–
e) number of licensed salvage yards					551	–
f) number of licensed transfer stations					8	–
g) number of licensed air curtain destructors					7	–
ENFORCEMENT						
1. Orders Issued	305	–	327	–	129	–
2. Orders referred to the Attorney General's Office	53	–	57	–	24	–

to the state Attorney General's office for legal action.

Statewide progress in licensing and enforcement for solid waste disposal operations is summarized in Table 2.1.

Enforcement Program Needs

1. Reduced time expended in enforcing compliance with Wisconsin Solid Waste Management Rules.
2. Authority to identify and control terminated and abandoned waste disposal sites.
3. More precise definition of rural containerized collection systems, new disposal site investigations, pyrolysis, storage and other elements of solid waste management.
4. A long-term rating and classification system for solid waste disposal operations.

EDUCATION, PLANNING AND TECHNICAL ASSISTANCE

Local units of government faced the pressures of compliance with the initial Wisconsin standards at a time of rising disposal costs. These pressures were compounded by steadily increasing waste generation, difficulty in locating and purchasing acceptable land disposal sites, and the lack of local knowledge and experience in good solid waste management practices. The waste management problems facing communities pointed to two critical and immediate needs:

1. A state program of information, education and technical assistance to aid in the development of more efficient systems.
2. A state program of assistance in planning and implementing cooperative, areawide solid waste management systems to take advantage of economies of scale, area resources, and organizational flexibility.

Following adoption in 1969 of the initial standards, early efforts at providing solid waste management education and technical assistance were carried out independently by the Department of Natural Resources and by the University of Wisconsin-Extension and Department of Civil Engineering. The Department of Natural Resources, at both central and district levels, provided assistance primarily through correspondence and frequent field contacts with local municipalities and private operators. The emphasis of these efforts was on interpretation of the standards and on techniques for improving land disposal methods. The University's Department of Civil Engineering trained sanitary engineering students. University of Wisconsin-Extension provided professional education through engineering institutes on such basic topics as "Principles of Sanitary Landfill" and "Elements of Solid Waste Management." Extension also held field demonstrations of sanitary landfilling techniques and did initial work on a model cost feasibility study of a countywide system for one rural Wisconsin county. Through these independent educational efforts and increased enforcement of the solid waste disposal standards, interest and experience in solid waste management gradually increased and the quality of disposal throughout the state began to improve. Progress in these areas, however, was partially offset by confusion regarding interpretation and enforcement of the standards, by local opposition to the standards, and by a general lack of knowledge concerning effective solid waste management practices. In addition, communities were reluctant to seek cooperative areawide solutions to solid waste problems.

In an attempt to develop statewide understanding of the standards and to initiate interest in improved and areawide waste management systems, the Department of Natural Resources, in March, 1971, held an informational meeting in Wisconsin Rapids. Nearly 200 local and county officials and solid waste contractors attended. The department was assisted by the Wood County University Extension office and the U. S. Public Health Service.

The results of that meeting and other educational projects indicated that major education and assistance programs would be most effective if conducted through a coordinated interagency approach. During the spring and summer of 1971 the Department of Natural Resources, in cooperation with county offices of the University of Wisconsin-Extension, conducted 40 informational meetings throughout the state. Their purpose was to explain the solid waste disposal standards, to discuss special disposal problems, to describe sanitary landfilling techniques, and to introduce the concept of areawide or countywide solid waste management. Concurrently, production of a movie entitled "Wisconsin Faces the Solid Waste Problem," was begun jointly by the University of Wisconsin-Extension and Department of Natural Resources, with assistance from the U. S. Environmental Protection Agency. This film emphasizes those solid waste problems encountered by small Wisconsin communities. It encourages conversion of dumps to sanitary landfills and offers suggestions for multi-municipal or areawide solid waste systems.

During the two years of regulatory activity, the need for legislation to enable regional government to become involved in solid waste management became more apparent. Less than a year after the implementation of the original solid waste standards a study sponsored by the Department of Local Affairs and Development (DLAD) presented evidence that county governments could provide systems that offered economy of scale and sites that up to then had been politically unfeasible. Entitled "Reconnaissance Study on Solid Waste Disposal," the published report of the study recommneded that counties be allowed to become involved in comprehensive solid waste management planning and operations.

Chapter 130, Laws of 1971, passed by the Wisconsin Legislature, was in accord with this recommendation. The DLAD was given responsibility for drafting administrative rules guiding preparation of county solid waste management plans. Both the DLAD and the DNR were to review completed plans to insure that they conformed with these rules and with the Wisconsin Solid Waste Management Rules. The DNR was given responsibility for final approval of plans.

A detailed analysis of the law was prepared for local government officials by the University of Wisconsin-Extension, in cooperation with DNR, DLAD, and the Wisconsin County Boards Association. The analysis was discussed over the state's Educational Telephone Network and was included in a manual entitled "Planning for Cooperative Solid Waste Management in Wisconsin." Solid waste management planning criteria (Chapter LAD 3 of the Wisconsin Administative Code) were also prepared and adopted pursuant to the county solid waste law.

Prior to passage of the county solid waste bill, the University of Wisconsin-Extension, DNR, and DLAD had already begun a major cooperative educational project. This project consisted of several parts. A model cost feasibility study for Sauk County was completed and a report prepared. That study established procedures, questionnaires, and techniques useful for similar studies in other counties. It indicated that similar studies could be made to evaluate for other counties or regions the potential cost savings and improved service possible through countywide or areawide systems. Another major part of the educational project was the development of two manuals for use by municipal and county officials and by specialists in the planning and designing of areawide systems. The first (mentioned above), "Planning for Cooperative Solid Waste Management in Wisconsin," was prepared to help local governments organize a cooperative, areawide approach to solid waste management. The second manual, "Technical Guide for Solid Waste Management," was developed for planning or investigating teams. It describes investigation and planning in more detail and explains the design and operation of waste management systems.

By the spring of 1972, after passage and analysis of the county law and adoption of planning criteria, many counties showed interest in becoming involved in solid waste management. A comprehensive educational package was prepared by the DNR, DLAD and the UW-Extension to assist in the planning and implementation of county and areawide systems. The movie, begun in the summer of 1971, was ready for use by March, 1972. Summaries and informational materials on the Sauk County Cost Feasibility Study were prepared and assembled. The planning and technical manuals were printed. Informational meetings based on these materials were held during April and May, 1972, in 10 regions of the state, and representatives from all counties participated. The agenda included a showing of the movie followed by discussions of the county law and corresponding administrative codes, waste management planning, the Sauk County study, and the roles of DNR and DLAD. The planning and technical manuals were also presented. Following these meetings, interest and involvement in areawide waste management plans and operations increased.

The DNR, DLAD, and UW-Extension have continued to provide technical assistance to counties and regions involved in planning and implementing waste management systems. DLAD planning funds have significantly encouraged and supported county and regional involvement throughout the state.

More recent interagency educational programming has been concentrated in two major areas: implementing areawide and county solid waste systems, and on solid waste recycling. A third manual, "Implementing Cooperative Solid Waste Management in Wisconsin," will be completed in spring, 1974. A draft of this manual, together with slide sets and other information, was presented throughout the state by UW-Extension, DNR, DLAD, and the Governor's Recycling Task Force in a series of regional training workshops. Workshops completed during September, 1973 emphasized the implementation of areawide waste management systems and the relationships of those systems with any future resource recovery programs.

As of January, 1974, nearly 80 percent of the counties in the state have voluntarily participated in planning, investigating or developing areawide solid waste management activities. Three counties are currently operating countywide systems (a central landfill in each case). The status of county solid waste management in Wisconsin is shown in Table 2.2

TABLE 2.2
County Activity

Counties operating solid waste management systems:	Fond du Lac, Green, Sauk
Counties with approved solid waste management plans:	Brown, Sauk
Counties with plans completed or underway:	Columbia, Dane, Door, Forest, Jefferson, Lincoln, Manitowoc, Marathon, Oneida, Outagamie, Ozaukee, Shawano, Sheboygan
Counties with inventories completed or underway:	Adams, Ashland, Barron, Bayfield, Buffalo, Burnett, Calumet, Chippewa, Clark, Dodge, Douglas, Dunn, Eau Claire, Grant, Iowa, Iron, Juneau, La Crosse, Lafayette, Marquette, Monroe, Oconto, Polk, Portage, Price, Richland, Rusk, St. Croix, Sawyer, Taylor, Trempealeau, Vilas, Washburn, Washington, Winnebago

General Program Needs

1. Funds for future county and areawide solid waste planning.
2. Expanded planning, education, and technical assistance.
3. Capabilities for planning and implementation.
4. A landfill operator certification program.
5. Onsite landfill operation training program using Department of Natural Resources instructors.
6. A smooth transition and coordination between ongoing technical assistance, planning, and education programs and those associated with future state and local resource recovery programs.

STATEWIDE INDUSTRIAL AND TOXIC AND HAZARDOUS WASTE PROGRAM

Industrial and toxic and hazardous waste materials pose many of the most critical health, safety, and environmental hazards within a solid waste management system. As a result of new wastewater treatment regulations and of new technology, more and more unusual and new wastes are being discharged on land. As these wastes find their way to the land, more waste management problems are being encountered. Improved systems for handling these wastes are needed.

At this writing Congress is considering federal legislation which will directly affect the Wisconsin toxic and hazardous waste program. Since state and federal programs for managing these wastes are in the formative stages, this section deals primarily with new activities and new programs. The information collected through them will fit directly into any future state program, regardless of how the federal legislation influences its direction and scope.

Waste Classification

An industrial and toxic and hazardous waste management program must deal with three general waste classifications:

1. Those liquid and solid waste materials which are specifically toxic or hazardous. This includes such wastes as pesticides, acids, caustics, pathological wastes, radioactive materials, flammable or explosive materials, and similar chemicals and harmful wastes which require special handling and disposal to protect the environment.
2. Industrial wastes which are not specifically toxic or hazardous but which require special handling and disposal methods to prevent environmental pollution. Many of these materials, including slurries or sludges and inert chemical or salt wastes, may require disposal procedures which are very similar to those for toxic and hazardous materials.
3. Other industrial wastes. These materials include such industrial refuse as wood, paper, glass, organic and inorganic portions of waste. They may be handled and disposed of in much the same manner as regular municipal refuse, and pose no unusual management problems.

Present Program Status in Wisconsin

Little is known about the types, quantities, locations and current disposal methods of Wisconsin's industrial and toxic and hazardous wastes. However, more and more problems with these wastes are being reported and documented. General information and studies conducted by other agencies are available, but much more detailed and comprehensive data are needed before a proper control program can be developed.

The DNR has taken several steps to guide and regulate the disposal of industrial and hazardous wastes in the interim period until a workable program can be completed. Disposal regulations pertaining to toxic and hazardous (T & H) wastes have been incorporated into the Wisconsin Solid Waste Management Rules. DNR has licensed a few T & H waste disposal sites and is investigating current disposal methods. Finally, DNR's Bureau of Standards and Surveys conducted a mail survey of 276 Wisconsin firms to ascertain the amounts of heavy metals being discharged to the air, land and waters.

The efforts will provide a base for a greatly expanded industrial T & H waste management program. In addition to identifying the types, amounts, and locations of the wastes being generated, the DNR will seek the answers to the following questions:

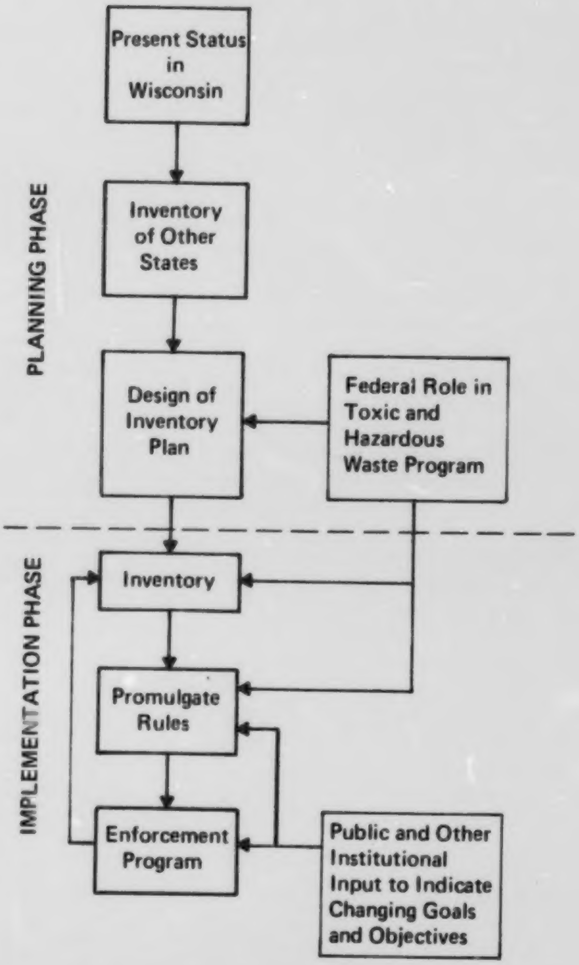
1. What storage, handling, processing, recovery, and disposal methods are currently being used, and with what success?
2. Where are these industrial and toxic and hazardous wastes now being disposed of?
3. What are the potential environmental, health, and safety hazards of these materials?
4. What facilities and capabilities now exist for handling these materials, and what additional facilities are needed?
5. How can the industrial T & H waste regulation and enforcement program be improved and expanded?
6. What special planning is needed for:
   a. Handling emergency waste situations?
   b. Developing administrative procedures?
   c. Instituting hazardous materials education programs?
   d. Developing cooperative industrial T & H waste management systems?
   e. Establishing uniform packaging, labeling, handling and shipping requirements?

Developing and Implementing the Program

The industrial toxic and hazardous waste program will be developed and implemented in six steps (Figure 2.1).

1. **Present status in Wisconsin.** This first step of the actual planning process is to gather as much preliminary information as possible about conditions in Wisconsin. This tentatively includes locating handling, processing, and disposal facilities. It involves gathering and organizing all previous relevant work done within the state. Preliminary steps will be taken to gather data and line up potential sources of out-of-state information.

FIGURE 2.1
Establishment of a Toxic and Hazardous Waste Program in Wisconsin


PLANNING PHASE
Present Status in Wisconsin
Inventory of Other States
Design of Inventory Plan
Federal Role in Toxic and Hazardous Waste Program
IMPLEMENTATION PHASE
Inventory
Promulgate Rules
Enforcement Program
Public and Other Institutional Input to Indicate Changing Goals and Objectives

2. **Inventory of other states.** Surveys and investigations conducted by other states will be reviewed in order to identify the procedures used, the problems encountered with their methods, the degrees of success achieved and the regulations resulting from their work. Existing programs and facilities will be reviewed for applicability to Wisconsin's program. Attention will be given enforcement procedures and special developmental and monitoring regulations required for air and land disposal of toxic and hazardous waste materials.

3. **Design of inventory plan.** When the background work has been completed, the next step will be to develop a detailed plan for conducting an in-depth study and inventory of the industrial and toxic and hazardous waste situation in Wisconsin.

To minimize duplication of effort between a toxic and hazardous waste inventory and an industrial waste inventory, the department will consider gathering data on both waste groups simultaneously. However, the survey may lead to separate guidelines and regulations for the management of toxic and hazardous materials aside from industrial wastes. The joint survey should not be interpreted as a grouping of industrial wastes ("special or other") with toxic and hazardous wastes for all management purposes.

The inventory plan will outline the procedures to be followed, and the manpower and resources required to conduct the statewide survey. A team of specialists may interview selected, representative industries on a county or regional basis. The remaining industries could be surveyed by mail to determine quantities and compositions of the wastes generated. Sampling representative industries in depth early in the survey may show where special wastes and problems exist, and give clues as to where to concentrate further investigative efforts.

4. **Conducting the inventory.** The actual inventory will be directed toward locating industrial toxic and hazardous waste management problems, as well as toward the gathering of specific information on existing conditions. It should point out the areas (geographical as well as topical) which require more research before environmentally sound management decisions can be made. It may also uncover such solutions to existing problems as new management methods or cooperative waste management systems.

5. **Developing industrial toxic and hazardous waste management rules.** Present state rules need to be expanded to reflect the seriousness of the actual problems and conditions in Wisconsin. Guidelines for dealing with special or emergency hazardous waste problems will be prepared.

One of the first will be to expand and revise the list of those materials now classified as toxic or hazardous. This may also require a classification-identification system for determining the major properties and characteristics of various waste types. A new listing of "special industrial wastes" is also needed. The toxic and hazardous waste regulations may be revised to include specific requirements for handling the various major classifications (or types) of hazardous materials.

It is expected, in light of recent federal recommendations on the processing of hazardous materials, that land disposal of bulk quantities of hazardous wastes will be discouraged, and processing and reclamation processes will be encouraged. The survey should provide enough background information on processing methods and facilities to include specific regulations governing their development, operation and maintenance. The department may require more detailed information in new site and facility proposals. Expanded regulations on environmental monitoring, reporting, inspection, and sampling of industrial and toxic and hazardous waste disposal sites are also strong possibilities.

Assuming that even with de-emphasis, land disposal of industrial and hazardous wastes will still be a major disposal method, present guidelines on the disposal of sludges, slurries, and other special wastes will also be revised and improved.

6. **Enforcement/Assistance Program.** The outgrowth of all the preliminary work to be done on industrial and toxic and hazardous wastes will be the development of a comprehensive regulatory-enforcement program. This is the portion of the program where the direct, working, problem solving contacts between the regulatory agency and the industry and public take place.

The DNR will provide information and technical advice and will encourage public input. This will be done through training and safety programs and through toxic and hazardous waste management workshops.

Enforcement will involve cooperation with DNR's chemists to establish guidelines and monitoring parameters for water and soil samples taken from industrial and toxic and hazardous waste sites.

While much work is currently being done, state legislation will be needed to expand and develop the program capabilities necessary to deal with industrial and toxic and hazardous waste management.

AUTOMOBILE RECYCLING AND SALVAGE YARD PROGRAM

Wisconsin has an active scrap metal processing industry, which currently handles about 240,000 vehicle hulks per year. These hulks comprise about 75 percent of the state's scrap metal processing load. The Department of Natural Resources controls sites where scrap metal is stored for future use or sale. The Wisconsin Solid Waste Management Rules include licensing and operational provisions for salvage yards and for scrap metal processing facilities. The most visible and pressing control problem is the auto graveyard where automobile hulks and other materials are abandoned without efforts at marketing. The graveyards are eyesores and are a waste of valuable resources, economy and technology. It is now feasible to recycle junked vehicles.

About 580 licensed salvage yards exist in the state; 200 do about 80% of all salvage business each year. In addition to these, 400 or more unlicensed sites may exist. Many are graveyards.

"Graveyarding" of auto hulks at licensed sites is often preventable. A questionnaire accompanies annual license application forms on which salvage yards report auto hulk turn-over rates. Answers to these questions can, in part, help to identify instances where hulk inventory is increasing without significant turnover or marketing. Efforts can then be made to encourage more active turnover.

General Program Needs

1. Differentiation between active salvage operation and auto graveyards.
2. Initiation of programs to reduce storage time of auto hulks.
3. Elimination of obsolete parts storage.
4. Coordination of existing programs to eliminate abandoned autos and auto graveyards.
5. Expansion of county and local salvage programs and coordination of these programs with the auto salvage and scrap metal industries.

RESEARCH PROGRAMS

Research efforts in Wisconsin related to solid waste management have been directed toward environmental considerations such as surface and groundwater pollution.

Most research has been conducted by the University of Wisconsin and Marquette University. Some has been funded by the Department of Natural Resources, Department of Local Affairs and Development, and the U.S. Environmental Protection Agency.

General Program Needs

At a minimum, expanded or original research is needed in the following areas:

1. Handling of solid waste and toxic and hazardous waste.
2. Procedures for information collection, storage and retrieval regarding solid waste management inventories.
3. Environmental considerations pertaining to handling and disposal of solid wastes.
4. Markets and institutional arrangements for resource recovery.

OTHER PROGRAMS

The Department of Natural Resources has several other ongoing programs. One is the examination of special waste problems. In the summer of 1973, several wood waste disposal sites were investigated in the state. The purpose was to document disposal methods and apparent problems. The results of the investigation are being applied to waste management and regulatory programs to insure the most efficient, problem-free waste handling possible.

Disposal of papermill sludge causes problems similar to those arising from wood waste disposal. A field inspection of papermill sludge sites, analogous to the investigation of wood waste disposal sites, is being conducted. Recommendations for an expanded program of licensing and control will be based on a summary of the study. Similar investigative activities will be carried out for other problem wastes.

As an aid for future solid waste management planning, a prediction model dealing with waste quantities and composition is being developed. The basic model was prepared as part of a project commissioned by the recycling task force appointed by the Governor in 1971. The concepts of this model are being computerized.

The model deals with generation of residential, industrial, and commercial wastes. Waste composition data is divided into several categories, and generation data is divided either by geographical regions for residential and commercial waste, or by Standard Industrial Classification Code for industrial waste. Generation predictions are based on current trends and on relationships developed in other research projects.

When fully implemented, this model is expected to be useful in the following ways:

1. It will assist planners, industrial officials, etc., who may wish to project the amount and composition of waste their industry will be generating.
2. It will provide a basis for waste management planning, in areas lacking specific detailed studies.
3. It will serve as a preliminary inventory of waste sources where such is needed. For instance, the data available from the computer model will be valuable in establishing a toxic and hazardous waste program in Wisconsin.

Work on transfer of the model concepts to the Department's computer system is expected to be completed by June, 1974.

The Department of Natural Resources is beginning to examine and organize data for water quality monitoring at land disposal sites. This program will be of significant use in evaluating environmental factors of site selection and operation.

Chapter 3 considers possible legislative alternatives for modification of the existing solid waste management programs.

The existing Wisconsin Solid Waste Management plan (goals, objectives, policies) and ongoing program activities are effective in meeting many of the state's solid waste management needs. In some cases program activities under the existing plan will help to point out needed plan and program alterations, particularly in such areas as toxic and hazardous waste management. However, some areas needing legislative action are already apparent.

This chapter discusses three of the more important additions which the Wisconsin Legislature may consider for the state's solid waste management plan. The alternatives considered here deal with expanded development of regional solid waste management systems and establishment of a major statewide solid waste recycling or resource recovery program.

RESOURCE RECOVERY

Resource recovery, or recycling, is the only means of managing solid waste which is totally acceptable in its environmental impact. Recycling should ultimately become an essential element of federal and state resource use cycles. While limited recycling of some materials is now efficiently done by the secondary materials industry and by in-plant manufacturing processes, large-scale recycling of municipal solid waste is not widespread. State participation in the development of municipal waste recycling programs will require the passage of new legislation.

Governor's Recycling Task Force

On July 15, 1971, Governor Patrick J. Lucey, through an executive order, created the Recycling Task Force on Solid Wastes. His principal charge was to "propose a plan for an all inclusive center to recover, reclaim, and recycle all types of solid wastes." The Governor further directed the group to "study existing technology, collection systems, reusable materials, and available markets" as well as sources of funds for the development of a recycling center.

After careful review the task force affirmed that recycling is feasible but that market development will take time.

Acting in accord with the recommendations of the Governor's Recycling Task Force, the legislature's Board on Government Operations appropriated $200,000 for the preparation of a preliminary engineering report. To prepare the report the three-man Board of Engineering Consultants was appointed by Governor Lucey in May, 1972. The Board was charged with providing information necessary for the preparation of engineering plans and specifications and making general recommendations for the financing, construction, and operation of recycling facilities.

Report of the Board of Engineering Consultants

The Board of Engineering Consultants' report consisted of a conceptual proposal for a statewide recycling authority, and an extensive discussion of the details involved in planning the technical aspects of a recycling program. The report concluded that:

1. A statewide recycling program is practical now in light of the cost of solid waste disposal, the current and projected markets for secondary materials, and the current state of waste processing technology.
2. A state authority is needed to provide all citizens of the state with good waste management service. However, to deal most effectively with varied waste production pattern, the authority should operate on a regional basis.
3. A well-conceived recycling system could be self-supporting, and could make use of the considerable resources Wisconsin already has in its secondary materials industry.

On the basis of these conclusions, the Board of Engineering Consultants recommended that the Wisconsin Legislature:

1. Create a Wisconsin Solid Waste Recycling Authority to implement a statewide program.
2. Grant to the authority needed powers to plan, acquire land, design, finance, construct, operate, maintain and make contractual arrangements necessary to transfer, transport, process, reclaim, market and dispose of solid waste.
3. Provide the initial financing to establish the authority and to construct facilities necessary to prove the viability of recycling.

Principles and Rationale of a Statewide Recycling Agency

As defined by the Wisconsin County Solid Waste Management Law, "Solid waste management means planning, organizing, financing, and implementing programs to effect the storage, collection, transporting, processing, recycling or final disposal of solid wastes in a sanitary, nuisance-free manner." At present, solid waste management includes only storing, collecting, transporting, and land disposing of wastes–sometimes with incineration or shredding as an intermediate step, and salvage as an ancillary activity. For these purposes various combinations of public and private agencies have been established locally to operate the solid waste management system under the regulatory control of local health departments and the Wisconsin Department of Natural Resources. Solid waste recycling, as one element of solid waste management, involves both regulatory and operational programs.

A statewide public policy of recycling implies an obligation on the part of the state to serve all of its people. The most urgent problems of solid waste management differ from region to region within the state. Although a statewide authority is needed to establish a policy of recycling, it is most practically implemented on a regional basis. Several considerations support this conclusion:

1. Few individual communities generate enough solid waste for economical recycling. A region encompassing a number of communities has more waste and could run a larger and more economical recycling activity.
2. The smaller communities, especially nonurban areas, do not generate enough waste to justify the cost of

expensive handling. This leads to substandard landfill practices, and as the Wisconsin Solid Waste Management Rules are applied to improve landfill operations, costs will rise.

3. Political subdivisions of Wisconsin were originally established for purposes unrelated to solid waste problems.
4. Some jurisdictions, especially in urban areas, are unable to dispose of solid wastes within their own boundaries.
5. A general-purpose area government concerned with transportation, recreation, utilities and other area problems usually has a geographic configuration that is unsuited to solving the solid waste problems of a region.

The Wisconsin Solid Waste Recycling Authority

Legislation to create a state agency, to be called the Wisconsin Solid Waste Recycling Authority, was introduced to the State Assembly in the summer of 1973. At this writing, the bill has been passed by Both the Assembly and is being considered by the Senate and awaits the Governor's signature.

The recycling authority is proposed to fill the gap in existing solid waste management practice in Wisconsin, and to work smoothly with the regulatory program which already exists. The bill specifies that the authority will use the services of the several state agencies including the Department of Administration.

The Authority is to cooperate with county, municipal, and other local agencies, and with private enterprise involved in solid waste management. More effective recycling programs will result as communities cooperate, markets develop, and recycling facilities become available. The Authority would be given a variety of business management powers appropriate to carry out its functions. It is expected to make maximum use of private enterprise and existing facilities, to make the program self-sustaining, and to make in-lieu-of-tax reimbursements for acquired facilities removed from property tax rolls.

The Authority will operate on a regional basis. A schedule is provided for the establishment of the first three regions, comprising a total of eleven counties. Other regions will be established as markets, technology, and design and construction time permit.

Within each region the Authority will be responsible for providing such facilities as rural container collection sites, transfer stations, recycling centers, and disposal sites for residues and non-recyclable materials. Recycling centers are to separate marketable material from waste and process the material to a degree sufficient to meet the specifications of prospective purchasers. The recycling centers may be owned by either public or private agencies, whichever arrangement would be in the best interest of the state. Under some circumstances, it may be appropriate for the facilities to be owned by a public agency, and operated by a private agency under contract. In any case, the Wisconsin Solid Waste Recycling Authority would maintain management control. All operations in the recycling program would be subject to the Wisconsin Solid Waste Management Rules.

In order to improve solid waste disposal practices for the more rural areas, and to include them in recycling programs, a collection system must be developed. The system suggested consists of 20 to 40 cubic yard containers, which would be placed at strategically located and specially prepared sites.

Since some components of solid waste cannot be recovered by any available process, and since residues will result from recycling operations, sanitary landfill will continue to be an essential part of solid waste management systems. For sparsely populated regions or those areas which do not have dependable markets for recoverable materials, the sanitary landfill will remain, at least for the present, the primary means of disposal.

PLANNING GRANTS FOR COUNTY AND REGIONAL SYSTEMS

Studies in Wisconsin and throughout the nation indicate possible economic, environmental, and political advantages in regional solid waste management plans and systems. Regional waste management will be essential to major recycling efforts.

In 1971 Wisconsin counties were given the authority to plan and implement solid waste systems. Since then, many have begun planning activities. In some cases the plans have led to the development of effective county systems. The initiative and incentive for planning solid waste programs has come primarily from regulatory pressures on existing solid waste operations, lack of available local disposal sites, state-level technical assistance, and state planning grants.

The Department of Local Affairs and Development, in the past, awarded grants (from the Community Development fund) to local and regional governmental groups. The size of this fund depends on legislative appropriations. Grants are generally awarded to promote planning and development of innovative programs. In the 1971-73 biennium, for example, about $25,000 was awarded for county and regional solid waste management planning. Several county and regional waste management plans and systems are underway, but new funds to support future planning have not been made available in the present budget of the Community Development Fund.

Although federal funds have occasionally been available for this type of activity, they cannot be counted upon in the future.

While many counties have initiated planning efforts and have benefitted from available planning grants, others are only now beginning to take steps toward planning. Some counties granted funds for previous plans or studies or for multi-county inventories are now starting to update these plans and to expand them for individual county use.

A program to provide sufficient funds to allow a county or regional organization to plan a solid waste management system or to update previous plans and studies would provide continued incentive to examine and implement regional systems where feasible. Systems planned and implemented under a state solid waste planning grant would provide groundwork for smooth transition to any future regional recycling systems.

Continuation and expansion of the state program for solid waste planning grant assistance requires action by the legislature.

MANDATORY COUNTY SOLID WASTE MANAGEMENT PLANNING

In Wisconsin, under Chapter 130 of the Laws of 1971, the county has been authorized to accept more responsibility for solid waste planning and management. A 1970 report sponsored by DLAD entitled. "Reconnaissance Study on Solid Waste Disposal," states that the Wisconsin County Boards Association feels, "The county will be required to become more active in local governmental affairs." This sentiment was also expressed in a 1965 Wisconsin Supreme Court ruling which states, "Realistically the county today is a unit of government with vital powers over the lives of its residents."

An alternative to consider in future solid waste planning in the state would be to require each county alone or in conjunction with other counties to submit a plan for solid waste management programs. Implementation of this alternative would provide county and municipal decision makers with plans containing information necessary to make intelligent decisions in solid waste management. The plans would allow objective examination of the merits of regional waste management in a particular county and would provide the best available information for implementing feasible systems. In addition, these plans would provide a first step in the transition from local solid waste operations to county systems and then to possible regional waste management under the Solid Waste Recycling Authority.

Many of the mechanisms for carrying out this alternative already exist. Legislative action would first be needed to amend existing solid waste laws to require mandatory county planning. It would also be necessary for the Department of Local Affairs and Development and the Department of Natural Resources to continue providing planning and technical assistance to counties and planning agencies. Assistance and planning input from the Wisconsin Solid Waste Recycling Authority would also be necessary. Continuing cooperation among these agencies together with regional planning commissions, planning and engineering consultants, and counties would be provided. Finally, state planning grants would provide essential support.

Mandatory county solid waste management planning appears to have a number of distinct advantages:

1. It will provide joint effort and establish the necessary lines of communication between the county government and municipalities.
2. Most counties are already served by planning commissions and other units that are capable of developing solid waste management plans. Several consulting groups are also becoming well qualified in this field.
3. It would provide municipalities and county government with the necessary information to make informed decisions on solid waste management.
4. A systematic investigation would disclose the advantages that a particular county could gain under a cooperative solid waste management system.

The three alternatives discussed in this chapter do not include the complete list of actions necessary to meet future solid waste management needs. However, they address some areas where needs are apparent. It is also expected that legislative action will be necessary in the future for programs such as industrial and toxic and hazardous waste management and sanitary landfill operator training and certification.

The dynamic process of program planning and implementation will aid in recognizing needs on a continuing basis and will help to define the types of programs required to meet those needs in the future.

Chapters 4 through 8 discuss technology, information, and data used to develop and modify solid waste management programs.

Part Two

INTRODUCTION

Planning, environmental regulations, county and intergovernmental cooperation, education and other programs discussed in Part I are key considerations in developing a good solid waste management system. However, these considerations only support the basic physical elements or services such as storage, collection, transportation, processing, disposal, and recycling. In the end, the quality of a solid waste management system depends on the functioning of these services. A change or failure in one will affect the adequacy and operation of others. It is these services that are at the root of any solid waste management regulatory, educational and planning program.

This part of the report covers in a basic way the physical elements or services of a solid waste management system. Objectives of this part are threefold:

1. To provide background information and support for discussion in Part I of the state solid waste statutes or existing plan, the programs and activities carried out as directed by statutes, and some legislative alternatives to meet future solid waste management needs of the citizens of Wisconsin.
2. To provide basic knowledge and understanding of the physical elements or services of solid waste management and how these services relate to the Wisconsin situation.
3. To introduce some of the major problem areas, data, trends, and relationships that apply to planning, implementing, and operating solid waste management systems.

CHAPTER 4 • SOLID WASTE GENERATION

INTRODUCTION

This section includes brief discussion of waste generation in order to provide some insight as to: the extent of the solid waste problem; how municipal, industrial, commercial and agricultural waste varies in composition; the factors affecting generation; and how Wisconsin and the United States solid waste generation compares with that of other countries.

The intent of this section is not to provide detailed data for developing a plan or report on solid waste in a specific area, but to present the concepts and principles involved in solid waste generation. Graphs and tables which are felt to adequately illustrate a concept or principle were chosen from a number of publications. While the data should not be taken literally, and is not in the most part from Wisconsin, the principles and concepts illustrated are valid and pertain to the Wisconsin situation.

The data pertaining to Wisconsin and obtained from work by the Governor's Recycling Task Force are generalized but provide the best current information available.

One of the objectives of state solid waste management planning is to institute an information acquisition and retrieval system on solid waste quantities. This information would be available to consultants, planners, and local communities studying solid waste problems. An important key to solid waste management planning is reliable solid waste composition and quantity information. Statewide surveys on industrial, and toxic and hazardous waste are planned for the next year to provide information on these aspects of the solid waste problem.

Solid waste management presently ranks third in municipal expenditures in this country. As communities look for ways to reduce waste management costs, they find it necessary to know more about the quantities and composition of generated waste, and the factors which influence generation rates. Most present knowledge about waste generation pertains to composition and amounts; it is not yet possible to assess (except in a general way) how such factors as personal and social attitudes and behavior will affect generation rates.

Waste generation results from all phases of human activity, as listed in Table 4.1.

TABLE 4.1

Selected Sources of Solid Waste

MUNICIPAL	Single-family dwellings	urban, suburban, rural
	Multi-family buildings	
	Streets	
	Utilities	
	Medical facilities	
	Public buildings	
	Parks and forests	
	Military operations	
COMMERCIAL	Hotels	
	Schools	
	Office buildings	urban, suburban, rural
	Restaurants	
	Stores	
	Auto service	
INDUSTRIAL	Natural resources (lumbering, mining)	
	Manufacturing	
	Processing	
	Assembly	
	Distribution	
AGRICULTURAL	Animals (rearing and processing)	
	Plants (culture and processing)	

This report considers three broad categories of waste sources: municipal (including residential, government, and recreation sources), commercial/industrial, and agricultural. Most of the data on municipal and commercial/industrial waste in Wisconsin comes from the Board of Engineering Consultants for the Governor's Task Force on Recycling in Wisconsin.

Methodology of Wisconsin Data

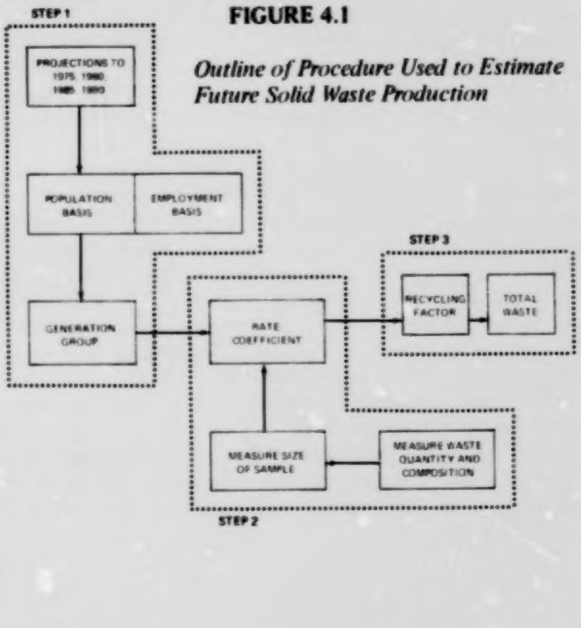
Projections of waste quantities and composition for 1975, 1980, 1985, and 1990 were done by and for the Governor's Task Force. Because of the tentative nature of the results, only the 1975 projections were used in the body of the report. Figure 4.1 shows the procedure used to arrive at projected estimates of solid waste. First, estimates for the size of the generating group were determined (Step 1 in Figure 4.1). For residential wastes, population projections obtained from the University of Wisconsin Population Laboratory were used. Employment trends, obtained by extrapolation from past employment growth figures, were used for industrial waste generation.

The next step was to establish waste generation coefficients for the various municipal and commercial/industrial sources (Step 2). These coefficients identify the amount of waste produced per individual (resident or employe) per day; they were obtained from various studies where waste production for municipal or industrial sample populations was carefully measured. For municipal generation, different waste generation factors were applied according to population densities being considered; similarly, different factors were used for different types of commercial and industrial establishments. Waste production was then calculated by using waste generation coefficients and population and employment projections (Step 3); in cases where a fraction of the material being considered is recycled, an appropriate adjustment was made.

Although the following discussion presents data on waste quantities and composition in Wisconsin, there is a need for further work to support or amend the data, as well as to study the factors which affect the generation rates. In addition, it should be kept in mind that the figures which will be presented are only averages—actual waste generation varies from county to county, town to town, and person to person. Although per capita figures are given, they are primarily accounting tools, and there is no attempt made to imply that behavior of specific municipalities or individuals is fully understood.

FIGURE 4.1

Outline of Procedure Used to Estimate Future Solid Waste Production



MUNICIPAL WASTE GENERATION

Municipal refuse generation of an area varies with many factors. While refuse increase is usually proportional to population growth, it also is affected by such factors as:

- affluence of the population of the area
- social customs of the area
- weather, as it affects moisture, length of growing season, etc.
- laws, such as burning bans
- economic base of the area
- packaging trends
- characteristics of waste collection services

In the U.S., municipal per capita waste production is about 3.3 lbs/day; for an average family, the rate is about 11 lbs/day. The portion of municipal waste termed residential is somewhat less; for individuals and families the generation rates are about 2 lbs/day and 5.5 lbs/day, respectively. The breakdown of municipal waste is shown in Table 4.2.

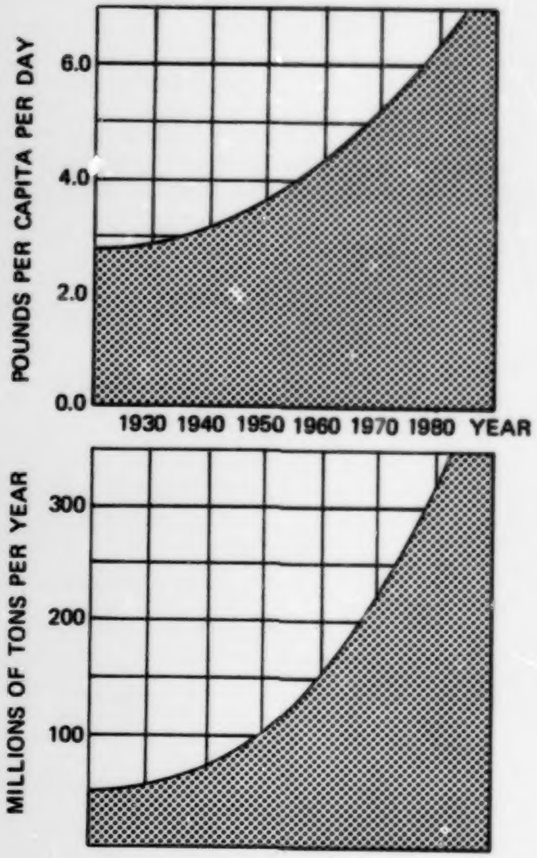


FIGURE 4.2 *Municipal Solid Waste Generation in the U.S. 1972 Estimates*
Top: Per Capita daily generation
Bottom: Total annual generation
From: The Problem of Solid Waste Disposal

Both the quantity and composition of waste vary with time. Figure 4.2 shows per capita generation figures, based on 1972 data. Clearly with increasing per capita generation and growing population, overall waste generation is increasing dramatically with time. The most noticeable change in waste composition has been an increase in paper content, which causes a reduction in density of generated waste. Lower density means greater volume, increasing collection and transportation costs, and greater processing and disposal costs. Beginning in the 1960's, another significant change in waste composition has been the appearance of plastics. Although these represent only a small fraction of total waste, they can create special problems due to their relatively inert nature and their chemical composition. A more detailed picture of municipal wastes in this country is given in Tables 4.3 and 4.4.

TABLE 4.2
Municipal Waste Composition in the U.S.

Food waste	17.6%	Rubber & leather	2.6%
Paper	31.3	Metals	9.5
Yard wastes	19.3	Glass	9.7
Wood	3.7	Textiles	1.4
Plastics	3.4		

TABLE 4.3
Generation of Residential Waste by Composition

	Basic Urban		Village		Rural		Remote	
	%	Lbs	%	Lbs	%	Lbs	%	Lbs
Newsprint	20	.44	15	.24	12	.13	15	.12
Magazines	10	.22	12	.19	10	.10	12	.10
Mixed	12	.26	13	.22	13	.13	3	.02
Corrugated	10	.22	12	.20	10	.10	12	.10
Fe Metal	7	.15	9	.15	15	.15	18	.15
Non Fe Metal	2	.04	3	.04	4	.04	5	.04
Glass	7	.15	9	.15	15	.15	18	.15
Plastics	1	.02	1	.02	2	.02	3	.02
Textiles	4	.09	3	.05	3	.03	3	.03
Food	13	.29	13	.21	13	.13	9	.08
Wood	2	.04	2	.03	2	.02	2	.02
Yard	9	.20	6	.10				
Unclassified	3	.07	2	.03				
Rate (lbs/cap/day)	100	2.19	100	1.63	100	1.00	100	.83

NOTE: Above figures are based on calculations for a seven-day week. Source: Board of Engineering Consultants.

TABLE 4.4

Generation of Non-Domestic Municipal Wastes

Material	Lbs/Capita/Day
Bulky	0.1
Street refuse; brush	0.4
Sewerage sludge	0.3
Auto	0.4
Demolition	1.4 (cities greater than 10,000) 0.3 (cities under 10,000)

NOTE: Above figures are based on calculations for a seven-day week. Wisconsin Solid Waste Recycling–Predesign Report, Board of Engineering Consultants.

Factors Affecting Municipal Generation

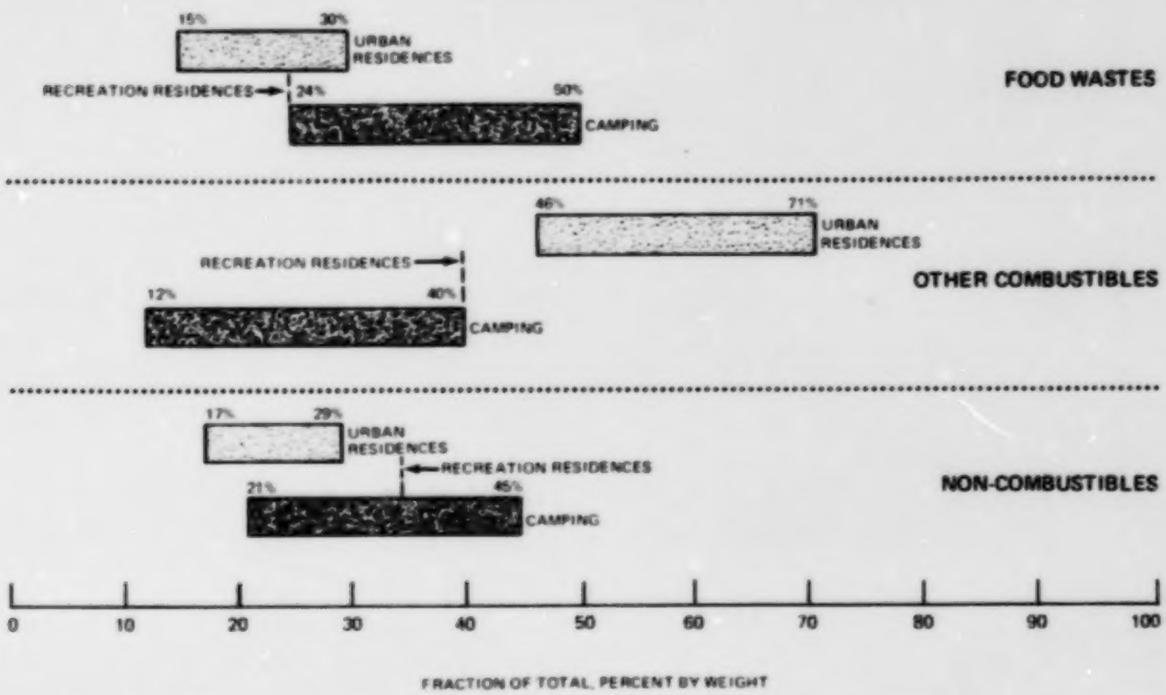
Tourism. Wisconsin's tourist industry has a significant influence on waste generation in some areas. In areas such as Wisconsin Dells, Devil's Lake, and Oneida County, solid waste generation can more than double during vacation season. Handling the wastes produced by tourist and summer homeowner populations requires special planning on the part of local governments and private landfill operators. However, the increased cost of handling these wastes is offset by increased economic activity from tourists and from tax base derived from summer homeowners who require few municipal services.

Most of Wisconsin's tourists are involved in outdoor recreation activities, e.g., swimming, camping, boating. Recreational wastes are compositionally different from normal municipal refuse, as shown in Figure 4.3. The most dramatic difference is the category, "other combustibles". This is due to the smaller quantity of paper discarded by people involved in recreational activities. Table 4.5 gives waste generation coefficients for specific activities. Table 4.6 lists recreational participation figures for Wisconsin during the summer months: June, July, and August.

For several of the categories listed in Table 4.6 little is known about the quantity and compostion of the generated waste; probably in many cases little solid waste is generated, and what is generated is disposed of in campgrounds or at municipal pickup points. Table 4.7 describes recreational solid waste generation for categories where generation coefficients have been determined.

Seasonal Variation. Another major factor affecting quantity and composition of solid waste is seasonal variation. For some waste categories, such as paper, garbage, metal, and glass, little variation will occur throughout the year. For other items, such as street refuse and yard trimmings, a noticeable increase will occur at times in the spring and fall months. Moisture content will also vary greatly with the season. Composition changes due to seasonal variations can be quite significant in terms of handling cost if the collection and transportation network has not been designed with these variations in mind.

FIGURE 4.3 *Observed Composition of Camping and Recreation Residence Solid Waste and Comparison with Urban Residence Values*



From: Solid Waste Management in Recreational Areas

TABLE 4.5

Waste Generation Rates for Recreation Sites

Recreation Site	Average Rate of Waste Generation
Campgrounds (lb/camper day)	1.26
Campgrounds (lb/visitor day)	0.92
Family picnic are (lb/picnicker)	0.93
Group picnic area (lb/picnicker)	1.16
Organization camps (lb/occupant day)	1.81
Resort areas	
Rented cabins (with kitchens) (lb/occupant day)	1.46
Lodge rooms (without kitchens) (lb/occupant day)	0.59
Restaurants (lb/meal served)	0.71
Overnight lodges in winter sports areas (wastes from all facilities) (lb/visitor day)	1.87
Day lodge in winter sports areas (lb/visitor day)	2.92
Recreation residences (lb/occupant day)	2.13
Swimming beaches (lb/swimmer)	0.04
Concession stands (lb/patron)	0.14

Source: Solid Waste Management in Recreational Areas.

TABLE 4.6

*Recreational Participation Figures**

Activity	Wisconsin Residents (7-day week) People/day	Non-Wisconsin Residents (7-day week) People/day	Total
Sightseeing	21,800	13,600	35,400
Picnicking	52,900	9,750	62,650
Swimming	77,200	30,600	107,800
Camping	17,700	9,880	28,375
Camping, remote	795		
Golfing	768	2,340	3,108
Hiking, < 4 hours	17,000	8,470	25,470
Hiking, > 4 hours	1,270	788	2,058
Biking, > 2 hours	2,000	1,110	3,110
Canoeing	3,625	3,520	7,145
Motor Boating	25,500	11,550	37,050
Waterskiing	10,000	5,250	15,250
Fishing	30,800	16,600	47,400
Nature Study	214	6,700	6,914
Off-road Vehicle	854	–	854
Other		5,350	5,350

**Based on data from the Senate Recreation Plan. Saturday and Sunday figures were converted to a 7-day week by multiplying by 2 for resident data. It was also assumed that non-residents only participated on weekends.*

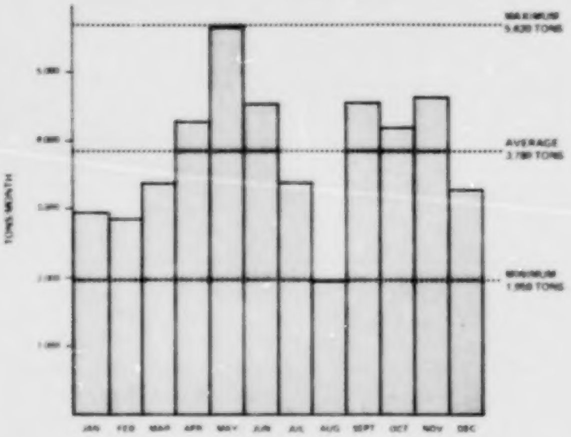
TABLE 4.7

Recreational Waste Generation in Wisconsin

Activity	Daily Participation	Yearly Participation	Lbs/Person/Day	Total Yearly Waste (summer months)
Picnicking	62,650	5,640,000	0.93	2,625 tons
Swimming	107,800	9,700,000	0.04	194
Camping	28,375	2,550,000	1.26	1,605

Figure 4.4 shows variations in tonnage collected in the City of Madison for 1972 by city crews with refuse packer trucks. The graph shows typical seasonal variations due to factors such as moisture content and yard wastes. In the winter the refuse is dry and light, low in tonnage and volume. After the spring thaw, when people are cleaning their yards, the tonnage climbs rapidly. Spring rains also make the refuse moisture content higher, thus increasing the tonnage. When grass and gardens begin to grow, lawn clippings, vegetation and summer rains keep the weight and volume of refuse high. In the fall, cleanup of yards and gardens produces heavy, wet refuse. As winter approaches, refuse quantity and weight decrease, with the exception that at Christmas large volumes of light, fluffy packaging material, and many Christmas trees are produced.

FIGURE 4.4 *Tons of Municipal Refuse for 1972, Madison, Wis.*



Socio-economic Influences. An important factor in influencing the quantity and composition of solid waste is the amount of money available to consumers. Countries with high standards of living consume resources at an extremely high rate. Often among the many socio-economic consequences of high resource use are (1) gross pollution of air, water and land resources and, (2) large quantities of solid waste to dispose of each year.

Figure 4.5 compares per capita waste generation in the USA, France, and Sweden (1962 data). The range of generation rates is due primarily to differences in standards of living among the countries and differences in levels of resource use. At a community or neighborhood level it is also possible to measure differences in generation rates based on varying incomes. Figure 4.6, representing data from an exhaustive study done in Jefferson County, Kentucky, illustrates this relationship. Unless some constraints are placed on solid waste generation, generation rates can be expected to increase as personal income rises.

Packaging. Another major factor affecting solid waste generation is the packaging revolution which has taken place since World War II. While some products have been considered overwrapped and overpackaged, sometimes simply to attract the consumer, many others are packaged to protect against spoilage, theft, or damage during transit. At any rate the trend in packaging use has been increasing. Figure 4.7 and Table 4.8 illustrate per capita consumption of packaging material from 1958 with projections to 1976. The increase of packaging use is approximately 12 lbs/capita/year (about 40 lbs/family/year). The present rate of consumption for an average family for just packaging material, is 1,970 pounds/year (including industrial and commercial waste).

Another significant change in the packaging industry has been the advent of the metal can and nonreturnable bottle. Figures 4.8 and 4.9 show the effects this change has had on containers for soft drinks and beer.

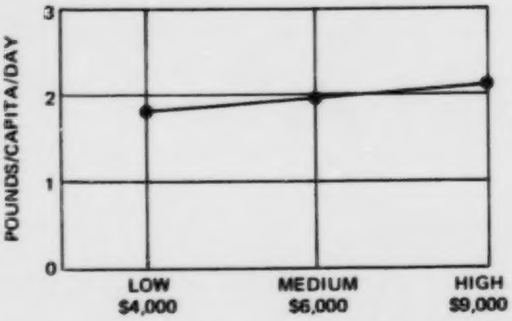


FIGURE 4.6 *Example of Variation of Waste Generation with Income From: Louisville, Kentucky–Indiana Metropolitan Region Solid Waste Disposal Study*

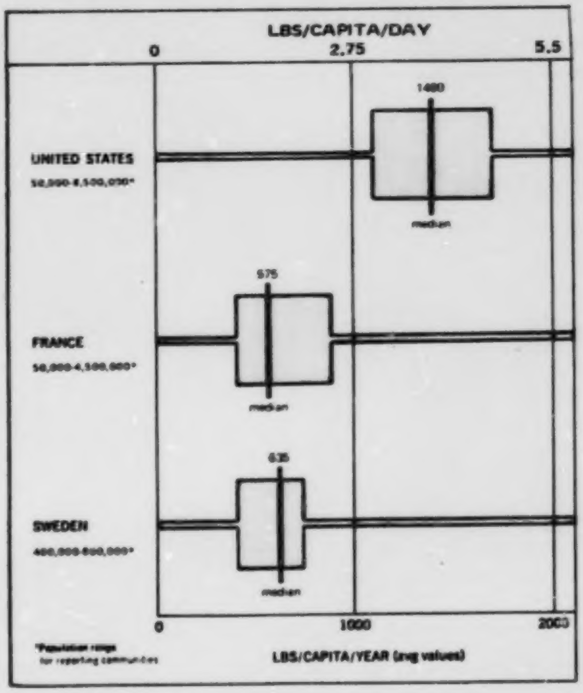


FIGURE 4.5 *Per Capita Waste Generation in the U.S.A., France, and Sweden (1959-61) From: The Problem of Solid Waste Disposal*

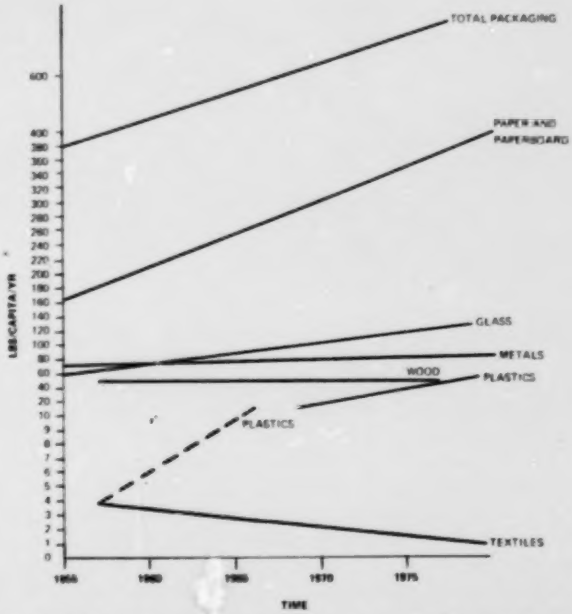


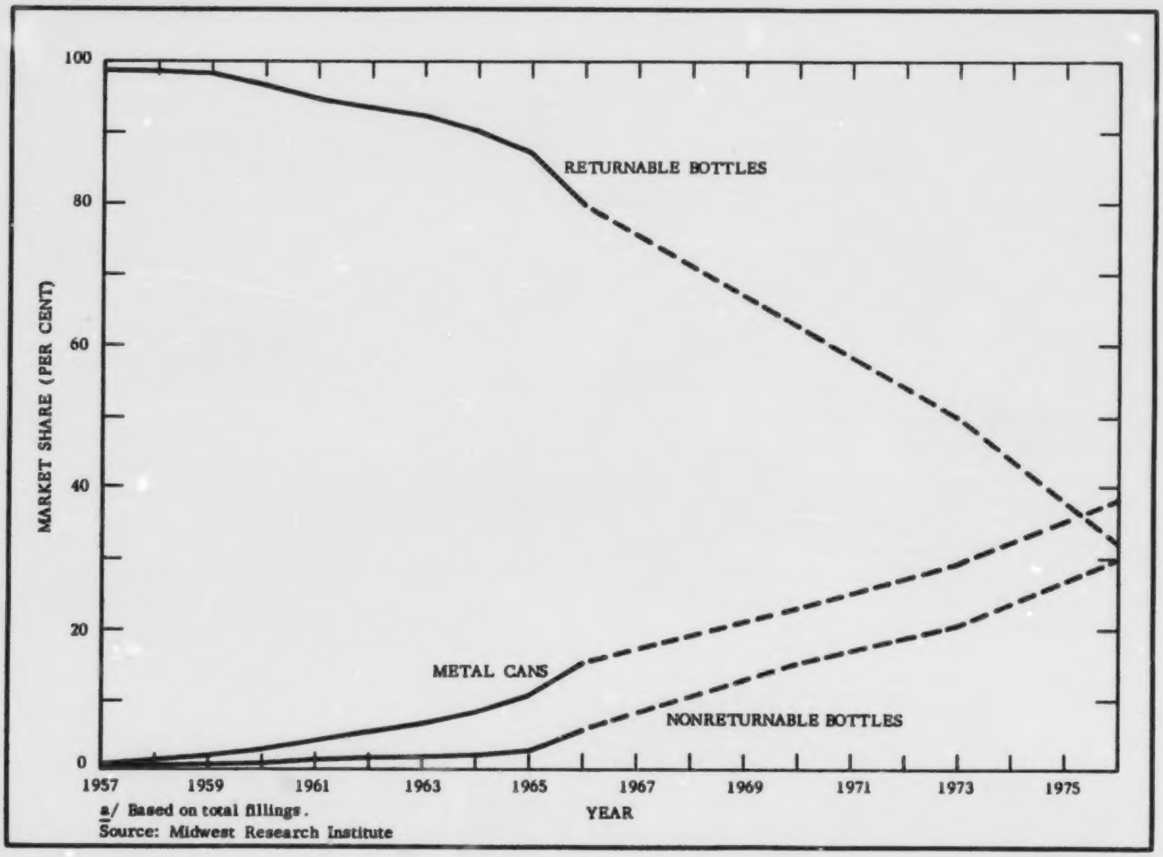
FIGURE 4.7 *Per Capita Consumption of Packaging From: The Role of Packaging in Solid Waste Management, 1966-1976*

TABLE 4.8

Per Capita Consumption of Packaging Materials by Kind: 1958–1976 (In pounds per capita)

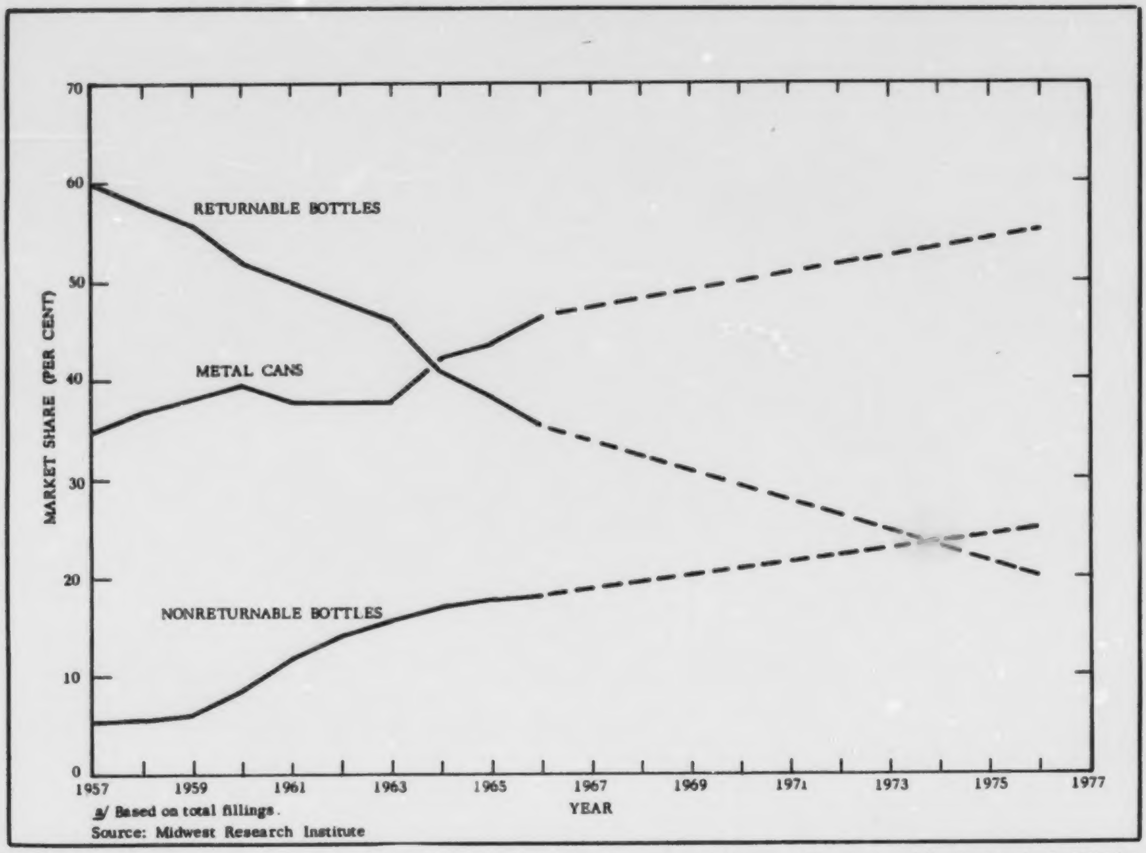
Type of Material	1958	1959	1960	1961	1962	1963	1964	1965	1966	1970*	1973*	1976*
Paper and paperboard	189.3	207.2	203.0	207.0	216.4	228.4	229.4	241.2	255.5	283.6	307.0	332.1
Metals	72.0	73.8	71.2	72.2	73.3	69.3	68.8	69.5	72.6	73.1	74.3	75.7
Glass	67.8	71.9	71.3	72.9	71.7	75.9	76.8	80.7	83.6	92.2	97.8	107.0
Plastics	4.2	4.9	5.4	6.2	6.9	7.7	8.4	9.7	11.2	17.6	22.0	28.2
Wood	41.2	44.1	39.8	39.1	40.0	41.3	39.7	40.4	41.2	40.7	40.3	39.8
Textiles	3.3	3.3	3.0	2.9	2.9	2.9	2.6	2.4	2.6	2.0	1.6	1.3
Total	377.8	405.2	393.7	400.3	411.2	425.5	425.7	443.9	466.7	509.2	543.0	584.1
Miscellaneous	26.6	29.1	31.9	35.3	39.0	44.6	48.3	54.3	58.3	68.4	72.5	77.0
Grand Total	404.4	434.3	425.6	435.6	450.2	470.1	474.0	498.2	525.0	577.6	615.5	661.1

*Series C population projection used for 1970, 1973, and 1976.
Source: U.S. Department of Commerce, Bureau of the Census. Current Population Reports, Series P-25, No. 372 and No. 359. Washington, D.C., 1967. Midwest Research Institute.
From: The Role of Packaging in Solid Waste Management, 1966-1976



a/ Based on total fillings.
Source: Midwest Research Institute

FIGURE 4.8 *Soft drink containers by type: 1957-1976 (market share in percent).*



a/ Based on total fillings.
Source: Midwest Research Institute

FIGURE 4.9 *Beer containers by type: 1957-1976 (market share in percent). From: The Role of Packaging in Solid Waste Management, 1966-1976.*

INDUSTRIAL WASTE GENERATION

Introduction

The very nature and diversity of its activities make industry subject to many unique and difficult waste handling and disposal problems; these range from handling toxic and hazardous wastes, to storing and disposing of large volumes of waste sludges, to disposing of large volumes of pathological and biological wastes.

In the first three years of solid waste management activity by the Wisconsin Department of Natural Resources attention has been directed toward the disposal of conventional wastes. However, it has been seen in this time that many industrial wastes do not fall into traditional categories, and thus cannot or should not be handled by traditional disposal methods; in some cases present disposal methods are unsatisfactory. Many industrial wastes pose potential environmental and public health hazards. Arsenic, for example, is present in the waste of certain pesticide manufacturing operations in Wisconsin, and unless care is taken, it can end up in ground and surface water reservoirs.

Toxicity and harmful effects of some wastes are only currently being discovered, yet these wastes often are disposed of with inadequate precautions.

A waste management system which provides for safe and efficient handling, storage, processing, disposal, and reclamation of industrial and commercial wastes can best be established by identifying the sources, amounts, and composition of the wastes generated. Presently, the best information available on the generation and composition of industrial and commercial waste in the United States comes from studies done in Texas and in Louisville, Kentucky. Because such surveys have not yet been done in Wisconsin, results of these studies have been applied to Wisconsin, to arrive at a rough estimate of the state's industrial waste situation. Specific information on the amounts, composition, and distribution of industrial and commercial wastes in Wisconsin is still needed in order to make wise waste management decisions in the future.

Quantity and Composition

Most of the figures available on the quantities of industrial and commercial solid waste generated are based on employment within each type of commerce or industry listed by the Standard Industrial Classification (S.I.C.) coding. The S.I.C. code is an exhaustive numerical scheme for classifying all phases of economic activity, much like the Dewey decimal system which is used to classify books in many libraries; its use is a widely accepted way to develop comparable statistics among different studies and reports. The S.I.C. codes extend to four digits, but a rough division may be obtained by using an abbreviated, two-digit form of the code. Table 4.9 indicates the two-digit S.I.C. code numbers which apply to various major industrial and commercial groups, as well as the 1971 figures for employment in Wisconsin within these groups:

TABLE 4.9

S.I.C. Codes for Major Industrial and Commercial Categories and Associated 1971 Wisconsin Employment Figures

Category	Two-Digit S.I.C. Codes	1972 Average Wis. Employment (1000s)
Mining	10–14	2.5
Construction	15–17	63.4
Manufacturing	18–39	493.6
Transportation, Communications, Utilities	40–49	81.7
Wholesale	50–51	67.9
Retail	52–59	278.0
Finance	60–67	64.1
Services	70–89	249.5
Public Administration	90–97	275.9
All other non-farm workers		142.4
(Farm)		(154.0)

In order to determine the county distribution of employment by S.I.C. groups, the Board of Engineering Consultants used census information from Wisconsin Unemployment Compensation reporting and manufacturing data. This information was then used with waste generation coefficients adopted primarily from the Texas and Louisville studies to develop estimates of the amounts of solid waste generated per county. A list of waste generation coefficients for Wisconsin, as obtained from the Texas and Louisville studies, appears in Table 4.10. Note that the S.I.C. code divisions in this table are more detailed than the preliminary divisions given previously. Table 4.10 also lists estimated statewide employment figures and the waste generation quantities for each industrial group division.

Industrial and commercial expansion projections were used with waste generation estimates by the Board of Engineering Consultants to produce estimated generation rates for 1975, 1980, 1985 and 1990. Figure 4.10 shows estimated commercial and industrial generation rates for 1975 by county, as well as population and employment projection. "Commercial" is interpreted to mean S.I.C. divisions above 50.

DATA SUMMARY

Table 4.11 presents a summary of the projected 1975 waste generation data for each county. This information, developed by the Board of Engineering Consultants, includes categories of municipal and residential wastes, as well as commercial and industrial wastes. The table indicates the magnitude of the solid waste problem in the state and how various areas compare in terms of amount of solid waste generated.

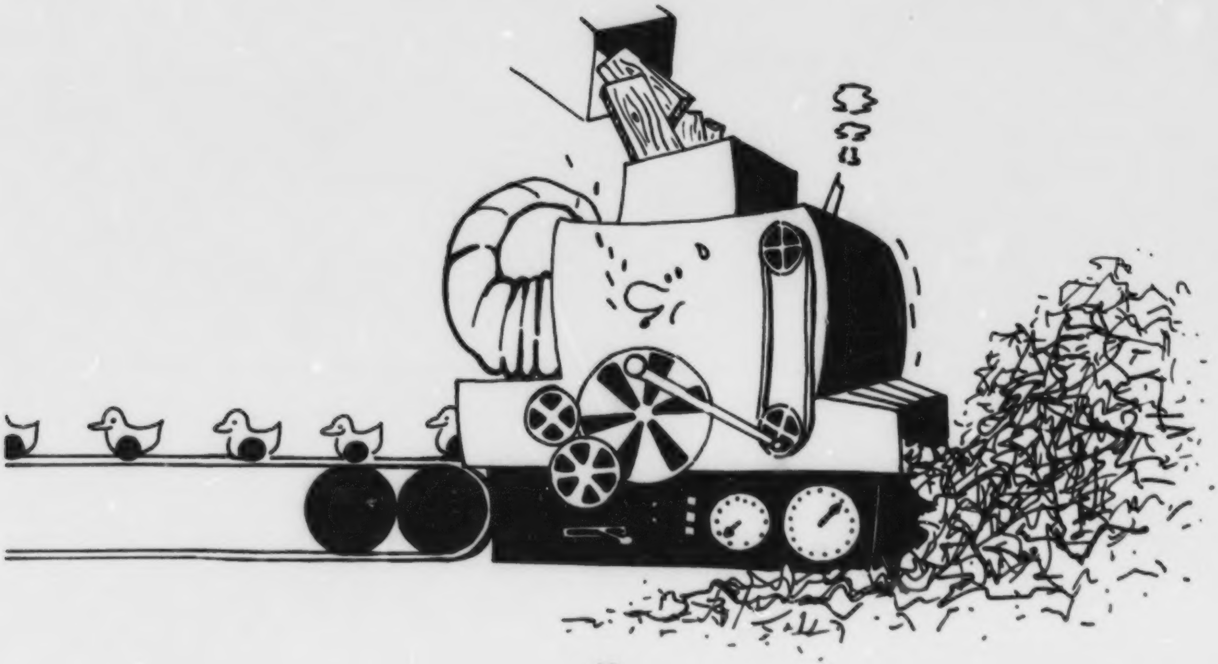


TABLE 4.10

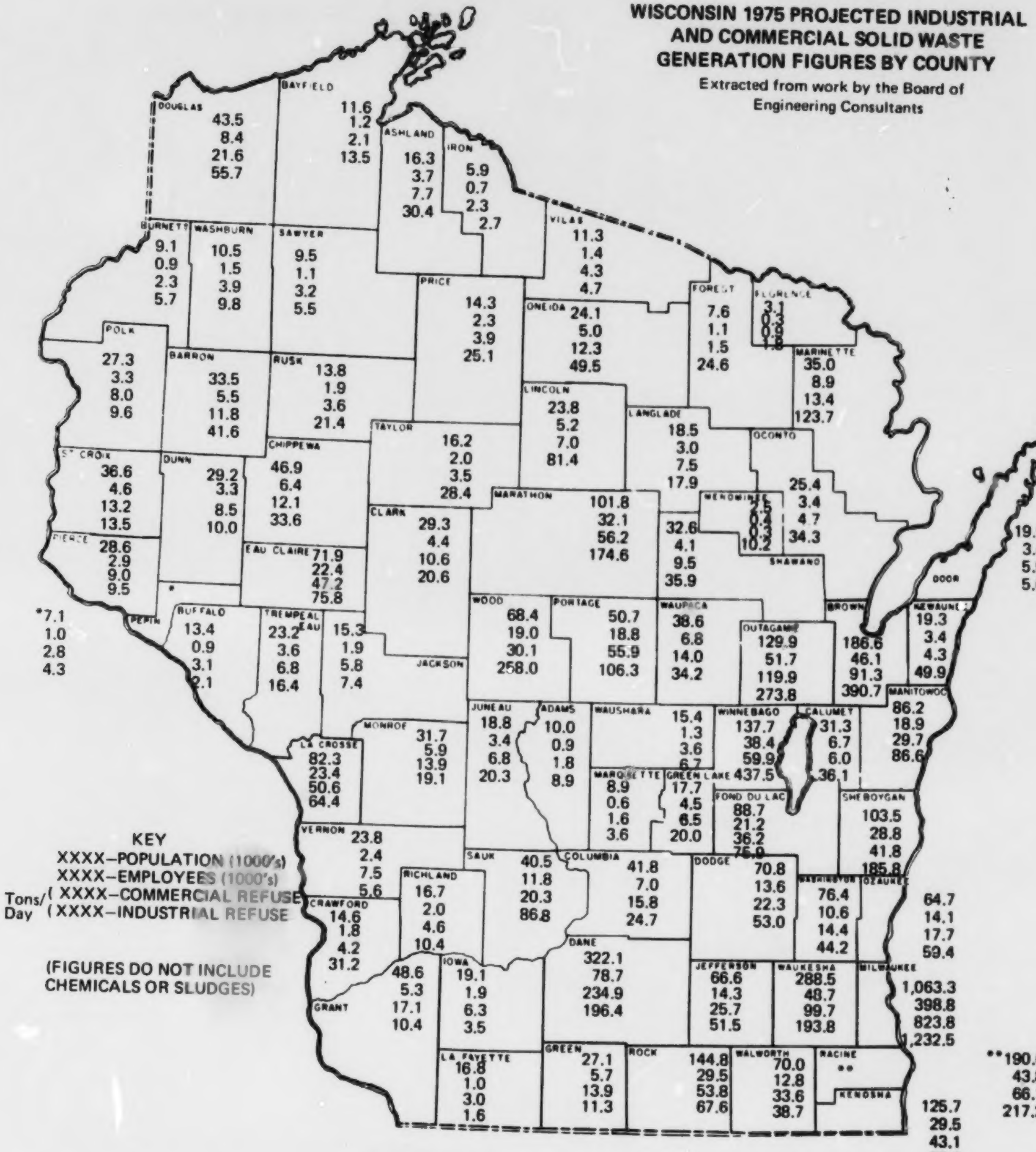
Waste Generation and Waste Generation Coefficients for Various S.I.C. Groups in Wisconsin

		Annual Averages (1972)		
S.I.C. Group	**Description**	**Waste Generation Coefficient lbs/cap/day**	**State Employment 1000s**	**Est. Waste Production tons/day (7-day week)**
20–39	Manufacturing		493.6	
20	Food products	26.7	57.7	770.3
22	Textile mill products	1.7	6.7	5.7
23	Apparel	1.3	7.0	4.6
24	Lumber & wood products, except furnitures	89.0	16.8	747.6
25	Furniture & fixtures	6.8	8.5	28.9
26	Paper & allied products	81.7	43.4	1,172.9
27	Printing & publishing	6.2	26.2	81.2
28	Chemicals	45.0	10.1	227.3
29	Petroleum refining	159.2	–	–
30	Rubber & plastics products	6.1	12.5	38.1
31	Leather & leather products	1.1	13.9	7.7
32	Stone, clay, glass & concrete products	125.0	8.3	518.8
33	Primary metals	36.8	28.1	517.1
34	Fabricated metal products	20.4	44.4	452.9
35	Machinery, except electrical	19.9	103.3	1,027.8
36	Electrical & electronic machinery	14.7	46.5	341.8
37	Transportation equipment	7.1	38.1	135.3
38	Precision instruments	1.9	8.8	8.4
39	Miscellaneous manufacturing industries	6.6	13.0	42.9
50–51	Wholesale trade	10.3	67.9	349.7
52–59	Retail trade		278.0	
52	Retail building materials	8.7	14.1	61.3
53	Retail general merchandise	1.5	60.7	45.5
54	Retail food	11.9	45.2	268.9
55	Auto sales, service, repairs	2.5	34.3	42.9
56	Retail apparel	2.4	11.9	14.3
57	Furniture	6.4	7.9	25.3
58	Eating & drinking establishments	12.5	55.5	346.9
59	Miscellaneous retail trade	5.4	25.7	69.4
60–67	Financial operation	7.1	64.1	227.6
70–89	Services		249.5	
70	Hotels	11.8	10.6	62.5
72	Personal services	2.3	14.5	16.7
73	Business services	4.1	19.0	39.0
76	Miscellaneous repair	9.1	2.0	9.1
79	Amusements, recreation	4.0	8.1	16.2
80	Medical & health	6.9	24.6	84.9
89	Miscellaneous services	4.1	7.9	16.2
90–94	Government		279.5	

FIGURE 4.10

WISCONSIN 1975 PROJECTED INDUSTRIAL AND COMMERCIAL SOLID WASTE GENERATION FIGURES BY COUNTY

Extracted from work by the Board of Engineering Consultants


DOUGLAS
43.5
8.4
21.6
55.7
BAYFIELD
11.6
1.2
2.1
13.5
ASHLAND
16.3
3.7
7.7
30.4
IRON
5.9
0.7
2.3
2.7
VILAS
11.3
1.4
4.3
4.7
FOREST
7.6
1.1
1.5
24.6
FLORENCE
3.1
0.3
0.9
1.8
BURNETT
9.1
0.9
2.3
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WASHBURN
10.5
1.5
3.9
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SAWYER
9.5
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3.2
5.5
PRICE
14.3
2.3
3.9
25.1
ONEIDA
24.1
5.0
12.3
49.5
MARINETTE
35.0
8.9
13.4
123.7
POLK
27.3
3.3
8.0
9.6
BARRON
33.5
5.5
11.8
41.6
RUSK
13.8
1.9
3.6
21.4
LINCOLN
23.8
5.2
7.0
81.4
LANGLADE
18.5
3.0
7.5
17.9
OCONTO
25.4
3.4
4.7
34.3
TAYLOR
16.2
2.0
3.5
28.4
ST. CROIX
36.6
4.6
13.2
13.5
DUNN
29.2
3.3
8.5
10.0
CHIPPEWA
46.9
6.4
12.1
33.6
MARATHON
101.8
32.1
56.2
174.6
MENOMINEE
2.5
0.4
0.3
10.2
CLARK
29.3
4.4
10.6
20.6
32.6
4.1
9.5
35.9
SHAWANO
19.6
3.4
5.9
5.6
DOOR
PIERCE
28.6
2.9
9.0
9.5
EAU CLAIRE
71.9
22.4
47.2
75.8
*
*7.1
1.0
2.8
4.3
PEPIN
BUFFALO
13.4
0.9
3.1
2.1
TREMPEALEAU
23.2
3.6
6.8
16.4
15.3
1.9
5.8
7.4
JACKSON
WOOD
68.4
19.0
30.1
258.0
PORTAGE
50.7
18.8
55.9
106.3
WAUPACA
38.6
6.8
14.0
34.2
OUTAGAMIE
129.9
51.7
119.9
273.8
BROWN
186.6
46.1
91.3
390.7
KEWAUNEE
19.3
3.4
4.3
49.9
JUNEAU
18.8
3.4
6.8
20.3
ADAMS
10.0
0.9
1.8
8.9
WAUSHARA
15.4
1.3
3.6
6.7
WINNEBAGO
137.7
38.4
59.9
437.5
CALUMET
31.3
6.7
6.0
36.1
MANITOWOC
86.2
18.9
29.7
86.6
MONROE
31.7
5.9
13.9
19.1
LA CROSSE
82.3
23.4
50.6
64.4
MARQUETTE
8.9
0.6
1.6
3.6
GREEN LAKE
17.7
4.5
6.5
20.0
FOND DU LAC
88.7
21.2
36.2
75.9
SHEBOYGAN
103.5
28.8
41.8
185.8
VERNON
23.8
2.4
7.5
5.6
SAUK
40.5
11.8
20.3
86.8
COLUMBIA
41.8
7.0
15.8
24.7
DODGE
70.8
13.6
22.3
53.0
WASHINGTON
76.4
10.6
14.4
44.2
OZAUKEE
64.7
14.1
17.7
59.4
KEY
XXXX–POPULATION (1000's)
XXXX–EMPLOYEES (1000's)
Tons/ (XXXX–COMMERCIAL REFUSE
Day (XXXX–INDUSTRIAL REFUSE
RICHLAND
16.7
2.0
4.6
10.4
CRAWFORD
14.6
1.8
4.2
31.2
DANE
322.1
78.7
234.9
196.4
JEFFERSON
66.6
14.3
25.7
51.5
WAUKESHA
288.5
48.7
99.7
193.8
MILWAUKEE
1,063.3
398.8
823.8
1,232.5
(FIGURES DO NOT INCLUDE CHEMICALS OR SLUDGES)
GRANT
48.6
5.3
17.1
10.4
IOWA
19.1
1.9
6.3
3.5
LA FAYETTE
16.8
1.0
3.0
1.6
GREEN
27.1
5.7
13.9
11.3
ROCK
144.8
29.5
53.8
67.6
WALWORTH
70.0
12.8
33.6
38.7
RACINE
**
**190.6
43.8
66.1
217.2
KENOSHA
125.7
29.5
43.1
92.2

STATE TOTALS
POP. 4672.6 (1000's)
EMP. 1231.4 (1000's)

TABLE 4.11

Summary Table for Estimated Industrial, Commercial and Residential Waste, by County for 1975

County	Population	Employes	Tons/Day (365 Days/Yr) Domestic	Bulky	Brush	Sewerage Sludge	Demolition	Automobiles	Commercial	Industrial	Total
Adams	9,998	861	5.2	0.0	0.0	0.0	0.0	2.0	1.8	8.9	17.9
Ashland	16,279	3,704	14.9	0.5	1.9	0.9	3.2	3.3	7.7	30.4	62.8
Barron	33,538	5,486	25.9	0.4	1.4	0.7	2.5	6.7	11.8	41.6	91.0
Bayfield	11,558	1,185	6.7	0.1	0.4	0.2	0.3	2.3	2.1	13.5	25.6
Brown	186,645	46,138	220.2	8.0	31.8	15.9	47.3	37.3	91.3	390.7	842.5
Buffalo	13,405	934	7.1	0.0	0.0	0.0	0.0	2.7	3.1	2.1	15.0
Burnett	9,078	911	4.6	0.0	0.0	0.0	0.0	1.8	2.3	5.7	14.4
Calumet	31,325	6,734	27.8	0.8	3.4	1.7	2.3	6.3	6.0	36.1	84.4
Chippewa	46,906	6,396	39.0	0.8	3.2	1.6	4.8	9.4	12.1	33.6	104.5
Clark	25,265	4,403	15.9	0.1	0.5	0.3	0.4	5.6	10.6	20.6	54.0
Columbia	41,839	6,966	27.3	0.6	2.5	1.2	1.7	8.4	15.8	24.7	82.2
Crawford	14,562	1,827	10.1	0.3	1.1	0.5	0.7	2.9	4.2	31.2	51.0
Dane	322,087	78,729	355.6	12.5	50.0	25.0	76.8	64.4	234.9	196.4	1,015.6
Dodge	70,787	13,573	55.5	1.6	6.2	3.1	7.3	14.2	22.3	53.0	163.2
Door	19,628	3,364	12.6	0.3	1.3	0.7	0.9	3.9	5.9	5.6	31.2
Douglas	43,482	8,458	46.9	1.6	6.3	3.1	10.7	8.7	21.6	55.7	154.6
Dunn	29,211	3,251	25.3	0.6	2.5	1.2	4.2	5.8	8.5	10.0	58.1
Eau Claire	71,894	22,358	80.1	2.8	11.3	5.7	18.8	14.4	47.2	75.8	256.1
Florence	3,147	258	1.5	0.0	0.0	0.0	0.0	0.6	0.9	1.8	4.8
Fond du Lac	88,701	21,195	85.4	2.6	10.6	5.3	15.7	17.7	36.2	75.9	249.4
Forest	7,617	1,053	4.2	0.0	0.0	0.0	0.0	1.5	1.5	24.6	31.8
Grant	48,558	5,267	34.0	0.8	3.2	1.6	2.2	9.7	17.1	10.4	79.0
Green	27,113	5,664	18.5	0.6	2.3	1.1	1.6	5.4	13.9	11.3	54.7
Green Lake	17,699	4,507	11.5	0.3	1.1	0.6	0.8	3.5	6.5	20.0	44.3
Iowa	19,144	1,906	12.4	0.3	1.1	0.6	0.8	3.8	6.3	3.5	28.8
Iron	5,898	742	3.1	0.0	0.0	0.0	0.0	1.2	2.3	2.7	9.3
Jackson	15,315	1,906	9.3	0.2	0.7	0.3	0.4	3.1	5.8	7.4	27.2
Jefferson	66,619	14,295	55.9	1.8	7.2	3.6	8.4	13.3	25.7	51.5	167.4
Juneau	18,812	3,374	11.7	0.2	0.7	0.4	0.5	3.8	6.8	20.3	44.4
Kenosha	125,661	29,453	147.1	6.0	24.1	12.0	33.9	25.1	43.1	92.2	383.5
Kewaunee	19,269	3,355	12.5	0.4	1.4	0.7	1.0	3.9	4.3	49.9	74.1
La Crosse	82,298	23,382	87.7	2.9	11.5	5.7	18.6	16.5	50.6	64.4	257.9
Lafayette	16,800	1,020	8.3	0.0	0.0	0.0	0.0	3.4	3.0	1.6	16.3
Langlade	18,511	2,975	14.4	0.4	1.7	0.9	1.2	3.7	7.5	17.9	47.7
Lincoln	23,795	5,205	21.8	0.7	2.6	1.3	3.8	4.8	7.0	81.4	123.4
Manitowoc	86,219	18,943	85.3	2.5	10.2	5.1	16.7	17.2	29.7	86.6	253.3
Marathon	101,789	32,092	91.6	2.0	7.9	3.9	12.2	20.4	56.2	174.6	368.8
Marinette	35,006	8,935	29.2	0.8	3.0	1.5	4.6	7.0	13.4	123.7	183.2
Marquette	8,872	644	4.4	0.0	0.0	0.0	0.0	1.8	1.6	3.6	11.4
Menominee	2,529	353	1.2	0.0	0.0	0.0	0.0	0.5	0.3	10.2	12.2
Milwaukee	1,063,310	398,772	1,306.6	53.2	212.7	106.3	321.1	212.7	823.8	1,232.5	4,268.9
Monroe	31,653	5,904	23.2	0.6	2.4	1.2	1.6	6.3	13.9	19.2	68.4
Oconto	25,436	3,382	18.7	0.4	1.4	0.7	1.0	5.1	4.7	34.3	66.3
Oneida	24,068	4,988	18.0	0.4	1.6	0.8	2.8	4.8	12.3	49.5	90.2
Outagamie	129,859	51,703	136.3	4.9	19.6	9.8	28.0	26.0	119.9	273.8	618.3
Ozaukee	64,668	14,143	74.1	2.3	9.2	4.6	8.4	12.9	17.7	59.4	188.6
Pepin	7,113	983	3.9	0.0	0.0	0.0	0.0	1.4	2.8	4.3	12.4
Pierce	28,611	2,949	17.5	0.4	1.5	0.7	1.0	5.7	9.0	9.5	45.3
Polk	27,271	3,298	21.0	0.3	1.4	0.7	2.3	5.5	8.0	9.6	48.8
Portage	50,686	18,756	49.4	1.6	6.4	3.2	9.9	10.1	55.9	106.3	242.8
Price	14,312	2,260	8.5	0.1	0.6	0.3	0.4	2.9	3.9	25.1	41.8
Racine	190,648	43,845	203.9	5.7	22.9	11.4	35.7	38.1	66.1	217.2	601.0
Richland	16,745	2,018	10.6	0.2	1.0	0.5	0.7	3.3	4.6	10.4	31.3
Rock	144,772	29,502	158.7	5.8	23.2	11.6	34.9	29.0	53.8	67.6	384.6
Rusk	13,824	1,868	8.7	0.2	0.8	0.4	0.5	2.8	3.6	21.4	38.4
St. Croix	36,625	4,597	30.5	0.5	1.9	1.0	3.3	7.3	13.2	13.5	71.2
Sauk	40,473	11,807	28.7	0.6	2.6	1.3	1.8	8.1	20.3	86.8	150.2
Sawyer	9,500	1,117	5.2	0.0	0.0	0.0	0.0	1.9	3.2	5.5	15.8
Shawano	32,608	4,123	22.7	0.3	1.3	0.6	0.9	6.5	9.5	35.9	77.7
Sheboygan	103,517	28,783	105.6	3.4	13.5	6.7	19.5	20.7	41.8	185.8	397.0
Taylor	16,239	1,987	9.8	0.2	0.7	0.3	0.5	3.2	3.5	28.4	46.6
Trempealeau	23,204	3,619	12.9	0.0	0.0	0.0	0.0	4.6	6.8	16.4	40.7
Vernon	23,789	2,429	14.2	0.2	0.7	0.4	0.5	4.8	7.5	5.6	33.9
Vilas	11,264	1,387	5.4	0.0	0.0	0.0	0.0	2.3	4.3	4.7	16.7
Walworth	70,037	12,758	60.3	2.2	8.8	4.4	9.5	14.0	33.6	38.7	171.5
Washburn	10,522	1,516	6.5	0.1	0.5	0.2	0.3	2.1	3.9	9.9	23.5
Washington	76,350	10,621	70.0	2.0	7.9	3.9	10.5	15.3	14.4	44.2	168.2
Waukesha	288,539	48,667	327.2	11.2	44.7	22.3	60.4	57.7	99.7	193.8	817.0
Waupaca	38,631	6,779	25.7	0.7	2.7	1.4	1.9	7.7	14.0	34.2	88.3
Waushara	15,351	1,328	7.9	0.0	0.0	0.0	0.0	3.1	3.6	6.7	21.3
Winnebago	137,727	38,381	157.1	5.9	23.7	11.8	36.6	27.5	59.9	437.5	760.0
Wood	68,418	18,978	69.9	1.8	7.3	3.7	12.5	13.7	30.1	258.0	397.0
State Total	4,676,629	1,208,215	4,750.1	158.4	633.6	316.8	910.5	935.1	2,482.5	5,535.2	15,722.2

Source: Board of Engineering Consultants.

AGRICULTURAL WASTE GENERATION

Introduction

Agriculture represents a substantial economic activity in Wisconsin. It is also responsible for the generation of a considerable amount of solid waste. Any solid material discarded in agricultural operations, with the exception of material dissolved or suspended in waste water effluents, constitutes what is legally interpreted to be solid waste. Wastes normally classified as agricultural wastes include field crop residues and specialty crop field and canning residues, animal wastes, animal carcasses, and wood residues.

Agricultural waste may become a problem if it is disposed of carelessly. Animal and crop residues will decompose, and the decomposition can result in offensive odors. The crop residue can also provide breeding media for large numbers of flies. Pollution of ground and surface water may also occur since precipitation in Wisconsin is high enough to create runoff and infiltration problems if large amounts of waste are left uncovered.

A substantial amount of agricultural by-products has always been recycled, but as certain operations become larger in scale, an increase in waste generation occurs. Agricultural wastes are difficult to manage, since most of the generation, distribution, and disposal of wastes occurs on private lands.

Sources of agricultural solid wastes include field crops, specialty crops, dairy cattle operations, and livestock and poultry operations; in addition, the forest industries generate large amounts of bark and sawdust.

Many of the agricultural waste problems which arise are the result of concentration. When animal waste from a small farm is spread on nearby fields, for example, there may be no problem. But when the manure from a 1,000-head cattle feedlot is stockpiled near a watercourse, serious pollution problems may result. Similar relationships exist for various crop residues.

Field Crops

Wisconsin field crops include hay, oats, field corn, soybeans, wheat, various grains, and other crops. It is difficult to accurately assess the amount of residue resulting from these crops, although some estimates are available. A study done in Oregon made estimates of tons of crop waste produced per acre per year, as well as tons of manure produced per animal, for livestock and dairy herds. A summary of this data is presented in Table 4.12. In this table, the waste production factor for crops represents all residues from harvested crops which remain in the field following harvesting or mobile processing operations, and all prunings and residues from fruit orchards. Animal waste production factors refer to animal feces and urine mixed with bedding, spilled feed, and soil. Animal waste production factors apply only to confined animals.

The significance of the Oregon data to the situation in this state can be inferred by comparing the Oregon waste production factors with Wisconsin production data, which are also listed in Table 4.12. Calculations of total waste production have not been made, because it was felt the Oregon waste production factors may not be directly applicable to Wisconsin; nevertheless, it should be possible from the figures given to gain an appreciation of where problems might be most significant.

TABLE 4.12

Agricultural Solid Waste Production Factors
State of Oregon

Crop	Annual Waste Production Factor	Wisconsin Acreage 1970-1971
Oats	1.5 tons/acre	1,687,000
Wheat	2.0	40,000
Barley	1.5	33,000
Clover, timothy, and alfalfa seed	1.5–3.0	35,000
Fruit trees	0.75	
Cranberries	0.75	6,300
Strawberries	0.75	1,700
Mint	0.25	9,500
Cabbage	1.5	5,800
Potatoes	1.5	52,000
Sweet Corn	4.0	118,000
Peas	2.0	125,000
Snap beans	1.5	50,000
Beets	1.5	5,800
Livestock		
Dairy cattle	13.0 tons/head	2,500,000 head
Beef cattle	7.5	[illegible] head
Hogs	1.75	1,770,000 head
Chickens (laying)	36.5 tons/thousand	7,950 thousands

Source: Agricultural Solid Waste Study; Oregon,1972.

In most cases, there is little problem arising from field crop residues, particularly when they are plowed directly into fields. However, they can cause odor and nuisance problems as well as water pollution when storage or disposal is poorly planned and carried out. Proximity to residences or places of public gathering, means of handling, surface drainage, and hydrogeologic and soils conditions are important factors in providing nuisance free, environmentally acceptable storage and disposal of field crop wastes.

Specialty Crops

The situation with specialty crops is somewhat different. Crops such as sweet corn, peas, and snap beans are grown for the harvesting of only a small fraction of their total bulk. Sweet corn kernels, for example, comprise only about 30% by weight of the total corn plant; and in processing, even some of the kernels are lost, for various reasons. Thus, there is a tremendous potential waste load resulting from canning operations. Some cannery wastes are in the form of wastewater effluents and others are in the form of solid residues.

Specialty crop solid residues left in fields may be used as fodder or forage, or may be plowed into the soil, usually causing few environmental problems. However, as with field crops, problems can occur from improper storage and disposal of residues from sweet corn, cranberries, peas, potatoes, cabbage, and other speciality crops. These problems do not occur regularly, and are generally isolated situations. Figure 4.11 shows state production of two specialty crops (corn and potatoes) and indicates where problems involving storage and disposal of crop residues are likely to occur.

A trend in the past has been toward increased solid waste problems as canning operations grow. More recently, however, a trend is developing toward in-field processing of crops, which prevents waste concentration. It is now possible, for example, to shell peas as they are picked, with the result that pods and vines may be left in the field, either for forage or to be plowed under. The change toward in-field processing is primarily the result of economic factors and aesthetic considerations in marketing; however, it carries with it a tendency to reduce waste disposal problems, and should, therefore, be encouraged.

Dairy Operations

Dairying is a substantial fraction of state agricultural activity, and Wisconsin leads the nation in the production of milk. Although a single cow produces about 10,000 pounds of milk in a year, the same cow produces about 26,000 pounds of manure per year–roughly 1.5 cubic feet per day. In 1971 there were about 1,856,000 milk cows in the state, including 10% nonproducing types, such as heifers. Table 4.13 shows the size distribution of dairy herds in Wisconsin in 1971.

Dairy herd wastes can be a special problem in [illegible] where feeding takes place in confined lots, which are often paved with concrete and located adjacent to barns, with easy access of stored feeds. In some cases, such lots are near lakes or streams, where surface runoff can cause serious water pollution problems. This is being examined by the U.S. Environmental Protection Agency, Wisconsin Departments of Natural Resources and Agriculture, University of Wisconsin, and others.

TABLE 4.13

Size Distribution of Wisconsin Dairy Herds
Number of Cows and Farms
(1971)

	Farms		Cows	
Herd Size	Number	Percent	Number	Percent
1– 9	5,826	10.2	27,265	1.7
10–19	10,713	18.7	159,212	9.6
20–29	15,724	27.4	383,427	23.1
30–49	19,563	34.1	723,857	43.7
50–74	4,394	7.7	252,453	15.2
75–99	760	1.3	63,456	3.8
100+	355	0.6	48,507	2.9
TOTAL	57,335		1,658,177	

Source: 1972 Wisconsin Agricultural Statistics.

Livestock Operations

The livestock population in Wisconsin is quite large; in 1970 the total cattle population in the state, including dairy cattle, was about 4,076,000. As previously noted, the population of dairy cattle was about 1.8 million–the remainder consists of beef cattle, bulls, and calves. The amount of solid waste produced by these varieties is about one-half that produced by dairy cows, or about 7 tons per head per year. There is a trend toward raising beef cattle on feedlots, which means greater concentration of solid wastes in small areas.

Animal Carcasses

Carcass disposal is another problem associated with livestock. Table 4.14 shows the number of animals reported lost in Wisconsin in 1971:

TABLE 4.14

Death Losses of Various Wisconsin
Livestock Varieties in 1971

All cattle	265,000
Hogs	160,000
Sheep and lambs	25,000
Chickens	920,000
Turkeys and broilers	No. est.

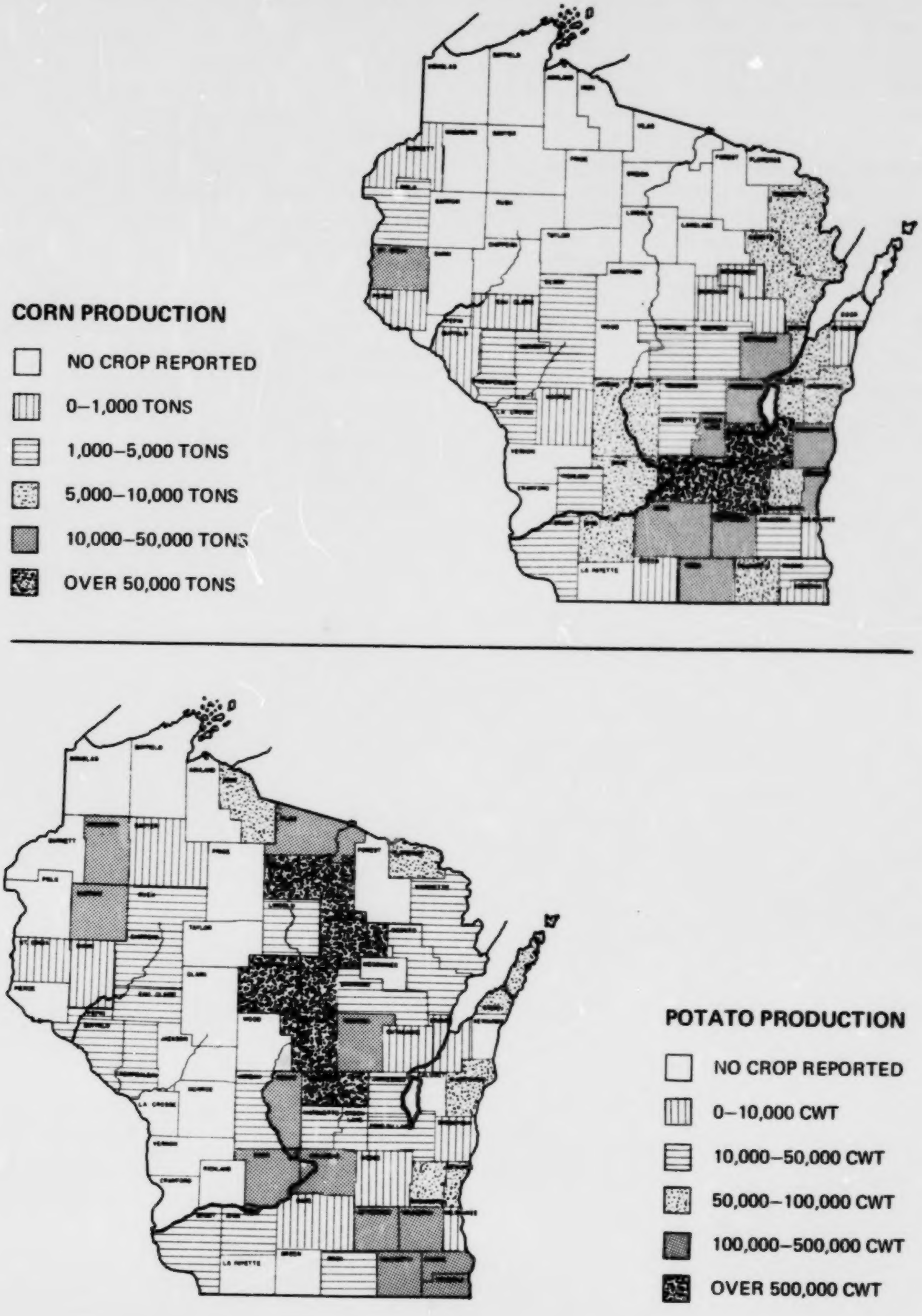
Source: 1972 Wisconsin Agricultural Statistics.

It has been the case in past years that animal carcasses were difficult to dispose of, due to the reluctance of rendering plants to accept dead animals. This situation has now changed, however, and there are many renderers throughout the state who will accept, and supply transportation for dead stock.

Wood Residues

An additional major source of agricultural and industrial waste in Wisconsin is the forest. Lumbering and pulpwood operations are responsible for the production of large amounts of bark, slabs, and sawdust; the storage of these materials in large piles can cause problems, particularly those involving fire danger and ground and surface water pollution. In some cases, it has been profitable to use these wood by-products in various ways: bark can be used as a mulch, and is used in highway construction projects; sawdust can be used as a mulch, especially if it has been aged, or it may be used as an excellent animal bedding; slabs can be chipped, and the chips used for papermaking, or for the fabrication of particleboard. In the past there has been little use made of wood by-products, because the source of the materials has often been distant from the

FIGURE 4.11 *State Distribution of Production of Sweet Corn and Potatoes by County in Wisconsin, 1971.*


CORN PRODUCTION
☐ NO CROP REPORTED
▥ 0–1,000 TONS
▤ 1,000–5,000 TONS
░ 5,000–10,000 TONS
▨ 10,000–50,000 TONS
▩ OVER 50,000 TONS
POTATO PRODUCTION
☐ NO CROP REPORTED
▥ 0–10,000 CWT
▤ 10,000–50,000 CWT
░ 50,000–100,000 CWT
▨ 100,000–500,000 CWT
▩ OVER 500,000 CWT

areas where use could occur, and transportation costs have been prohibitive. As new markets occur, and transportation rates for wood by-products allow competition with other raw materials, disposal of these products is decreasing, and their use is increasing. A change in this direction has been occurring over the last few years, and it is difficult to determine what fraction of bark, chips, and sawdust is presently reused and what fraction is discarded. However, Professor John McGovern, of the University of Wisconsin in Madison, has supplied the estimates for 1970 shown in Table 4.15.

TABLE 4.15a

Estimated Production of Bark, Chip Screen Fines, and Sawdust in Wisconsin in 1970

Wisconsin pulpwood production	1.5 million cords
Wisconsin sawtimber production	1.3 million cords
Pulpwood imported from other states	1.2 million cords
Total wood processed	4.0 million cords
Bark (250 bls/cord)	500,000 tons
Pulpwood bark	315,000 tons
Sawmill bark	185,000 tons
Chip screen fines	45,000 tons
Sawmill sawdust	235,000 tons

TABLE 4.15b

Disposition of Bark Residues in Wisconsin in 1970

Burned	305,000 tons
Disposed on land	190,000 tons
Other	5,000 tons

Of the bark burned in Wisconsin in 1971, an estimated 217,000 tons was burned for recovery of steam, and 131,000 tons was burned simply as a means of disposal.

Summary

Agricultural waste arises from the production of the most basic essentials of human existence. On the one hand, it must be expected that agricultural production will continue to increase as long as population continues to increase. On the other hand, agricultural by-products are particularly well-adapted for natural recycling, or a variety of secondary uses, so there is reason to feel that problems arising from waste could be satisfactorily alleviated. In Wisconsin, farmers and other agriculturalists cooperate with county agricultural agents, and the University of Wisconsin Agricultural Extension. This combination has been quite effective in identifying and dealing with pollution problems that have arisen. In considering the facts that have been presented regarding agriculture in Wisconsin, it is important to realize that large numbers do not always mean large problems; but when problems are encountered, it is probably the case that local concentrations of certain materials are occurring. Since most agricultural wastes are natural products of an organic nature, the possibility exists to deal with the wastes in an environmentally acceptable manner by returning them to the soil–and in many cases to the fields from which they were produced.

• • • • ● CHAPTER 5 • STORAGE, COLLECTION AND TRANSPORTATION

INTRODUCTION

Objectives of a local solid waste management system are generally to extend services which provide sanitation, economy, efficiency, and environmental, social, and political acceptability. These services which are performed for the public good include several elements; storage, collection and transportation are the initial elements and are the closest to the public. These elements are directly interrelated. A change or failure in one will affect the others.

Sanitation worker strikes in cities throughout the country have dramatized the problems when one of these elements fails. Though not publicized on a national scale, a strike in West Allis in 1973 had a more local emphasis. Figures 5.1 (A-C) were taken during this strike; they indicate storage problems which can occur if collection and transportation systems are not working efficiently.

FIGURES 5.1 a–c *Refuse which accumulated in West Allis, Wisconsin, during a 1973 sanitation strike left a large clean up problem behind.*

SOLID WASTE STORAGE

Storage of solid waste is the first element included in most solid waste management services. Solid waste which is improperly stored can cause esthetic, health, and environmental problems, and can significantly decrease the efficiency of collection services. (Figures 5.2, 5.3.) Single family residential waste is generally stored in containers of from 5-55 gallon capacity, from which collection is made. The size of the container determines how much weight it will hold, and this is of primary importance in designing collection systems.

The most commonly used residential container is the 30 gallon galvanized iron can with tight-fitting cover. Such a can is durable, easy to clean, and relatively animal proof. Plastic cans are also common—these have the disadvantage of cracking easily in cold weather and they may be penetrated by rodents.

More and more residential areas use bags for waste storage (Figure 5.4). Plastic or wet-strength paper bags may be used; they are discarded with the waste they contain. Often municipalities supply such bags to residents either free or at a minimal charge. Use of bags adds a small amount to the already existing waste load, but it can cause as much as 50% savings in collection costs.

In areas where there are apartment buildings, larger containers may be used. Boxes of from 2-4 cubic yard capacity can accommodate the wastes of a large number of residents. Such boxes are unloaded automatically by a specially designed truck. This is considerably more efficient than manually picking up a large number of smaller containers. A single three-yard box has the capacity of about twenty 30-gallon containers.

In rural areas the 5-50 cubic yard box is often used. If residents are required to haul their waste for a limited distance, a strategically located box may receive the wastes of all residents within a mile, two miles, etc.

Commercial and industrial wastes, when not hauled by the generators themselves are most often hauled by private contractors. They generally are not easily stored in small containers and are, therefore, usually stored in boxes similar to the ones mentioned above. However, the quantities of waste produced by commercial and industrial concerns often require larger containers, sometimes as much as 80 cubic yards.

There are three basic types of transfer containers: small containers (1-10 yd^3), which are unloaded on-site into a packer truck; larger containers (15-75 yd^3), which must be hoisted or pulled onto truck beds before being hauled to a disposal site for unloading; and enclosed containers or trailers which use stationary compactors to compress waste for higher storage densities. The latter type of container or trailer is usually hauled to a disposal site for unloading.

Certain types of waste, such as bulky refuse, street refuse, tree trimmings, demolition materials, and old car hulks are not easily stored in containers. Their storage is primarily an esthetic problem. More significant problems may occur with collection and transportation of these wastes.

Some industrial and agricultural wastes are stored in piles, lagoons, or pits. Bark, sawdust, and cranberries are examples of waste commonly stored in piles. Paper mill

FIGURE 5.2 *Improperly stored waste is an esthetic blight, as well as a potential source of health and environmental problems.*

FIGURE 5.3 *Rats find a ready source of food at open containers.*

FIGURE 5.4 *Use of bags can save time and money in waste collection.*

sludge and ash are often stored in lagoons until a sufficient quantity has accumulated to remove it and place it in a disposal site. Pea and corn wastes are often stored in a pit in the ground (ground silo) until they are reused for animal feed or disposed of on land.

Some types of industrial wastes of the toxic and hazardous variety require special storage consideration. Examples of these are radioactive wastes, flammable liquids, and acid and caustic wastes.

COLLECTION AND TRANSPORTATION SYSTEMS

Solid waste collection has traditionally been considered one of the municipal public works functions. In some cases municipalities provide collection of all residential, commercial and industrial wastes; in others only residential collection is provided by the municipal work force, with industry and commerce providing their own collection or hiring a private collector. In a growing number of instances all the solid waste in a community is collected by private haulers. In rural areas of Wisconsin, collection and transportation are often the responsibility of individual residents, although an increasing number of areas are arranging for organized collection services, either municipal or private. In Wisconsin the level of collection service and who provides it are considered local decisions.

Collection and transportation of waste frequently amount to 70-80% of total handling and disposal costs. Thus, much attention is given by those who design municipal budgets to this phase of waste management.

A previous section of this report discussed quantities of solid waste generated. The amount of solid waste collected is often less than the amount generated. This is due to several factors:

1. frequency of collection; infrequent collections may cause residents to dispose of some waste by themselves.
2. amount of open burning allowed.
3. use of on-site incinerators.
4. use of garbage disposals.
5. salvage of fractions of generated waste.
6. collection charges assessed directly to waste producers; high charges may encourage individual hauling.
7. population density; in rural areas, waste may be entirely hauled by residents, whereas in large cities it may be completely handled by public workers.
8. on-site disposal.

Depending on these factors only 50-75% of the total solid waste generated may be transported to a disposal site.

The objective of any collection and transportation system is to get waste materials from source to point of processing, and final disposal. To reach this objective four basic alternatives are available:

1. residents/industries are responsible for hauling own waste to disposal site.
2. municipality provides collection, transportation services.
3. municipality provides collection, hauls waste to transfer station or processing facility.
4. collection done by private contractor, waste hauled to disposal site, transfer station, or processing facility.

If waste is taken to a transfer station or processing facility, an appropriate transportation link must also be provided between either of these and the final disposal site.

Many considerations influence the process of choosing among the above alternatives. What services are considered to be provided by the local property tax dollar? What amount of service does the community need, or want? What special types of waste must be handled? How much money is the community willing to spend and how much do the various alternatives cost? After these major questions have been answered, numerous minor questions still remain concerning how to carry out chosen alternatives. Should large trucks with large crews be used? Should central containers for groups of houses be used?

Cost and service are closely related. The more service that is provided, the greater the cost will be. No definite method for determining the "best" type of service for a municipality or an area is apparent. Rather, a decision must be made in each case as to how much service is desired, based on the costs involved.

The decision will be complicated by considerations not only of necessary equipment and personnel, but also of several other factors: collection frequency, use of auxiliary equipment, and route scheduling, special wastes, and financing methods. While it is not within the scope of this report to discuss thoroughly the above factors, it is appropriate to mention them briefly.

Available Equipment

A large variety of equipment is available for the collection and transportation of waste. Depending on the service offered, collection trucks may range from small packers, designed for the reception of waste from homeowner's containers, to special large trucks capable of carrying fully loaded bulk storage containers or stationary compactors, or industrial tank trucks for liquid wastes.

Figures 5.5 (a-i) give an idea of the types of vehicles which are available and the applicability of each. Note especially the auxiliary vehicle shown in Figure 5.5g and the truck for carrying roll-off containers shown in Figure 5.5h. Auxiliary vehicles can be very useful in cases where residential waste containers are picked up from within property limits or in cases where pickup points are sparsely located on streets. These vehicles are less expensive and more easily operated and maneuvered than larger trucks, and they can reduce the number of men needed in pick-up crews. Figure 5.5i gives a good idea of how a roll-off container is loaded onto a truck. It can be seen that a large variety of equipment is available; the type chosen will depend on a community's needs and resources.

Personnel

Personnel provisions are also major considerations in designing a collection and transportation scheme. Some circumstances may require crews of several men. In other cases, a single man can satisfactorily drive a truck and perform the pick-up of waste. This will depend on the type of waste being collected, the type of equipment used, the frequency at which collections are made, and the density of collection points.

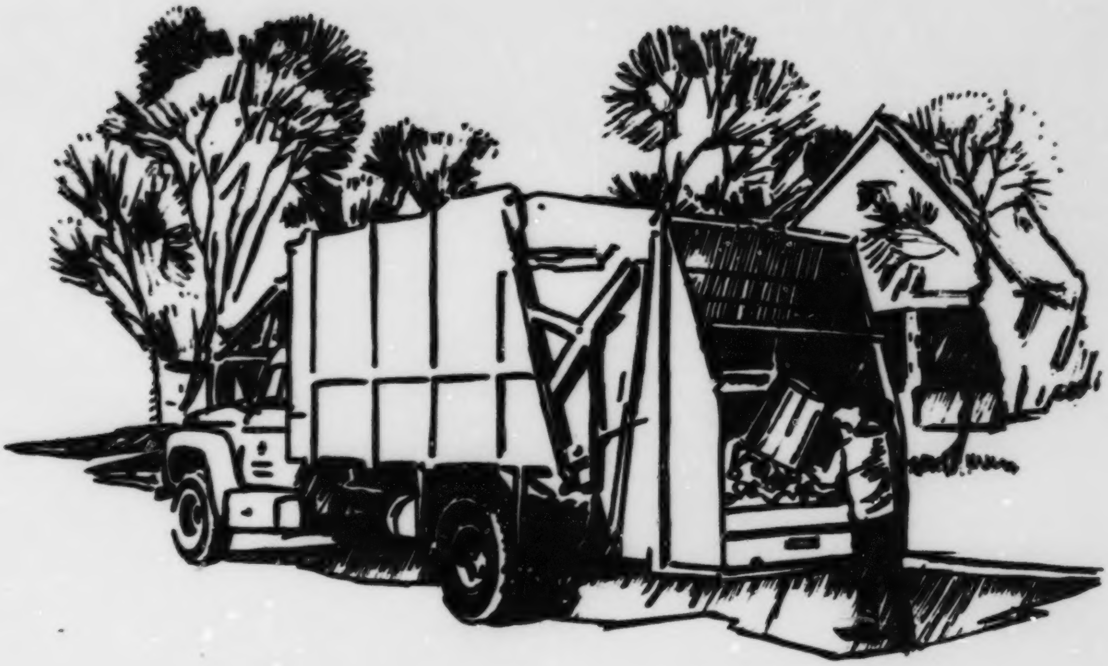


FIGURE 5.5a *Manual Pick-Up Rear Loading Packer: This vehicle is widely used when solid waste is collected from within properties.*

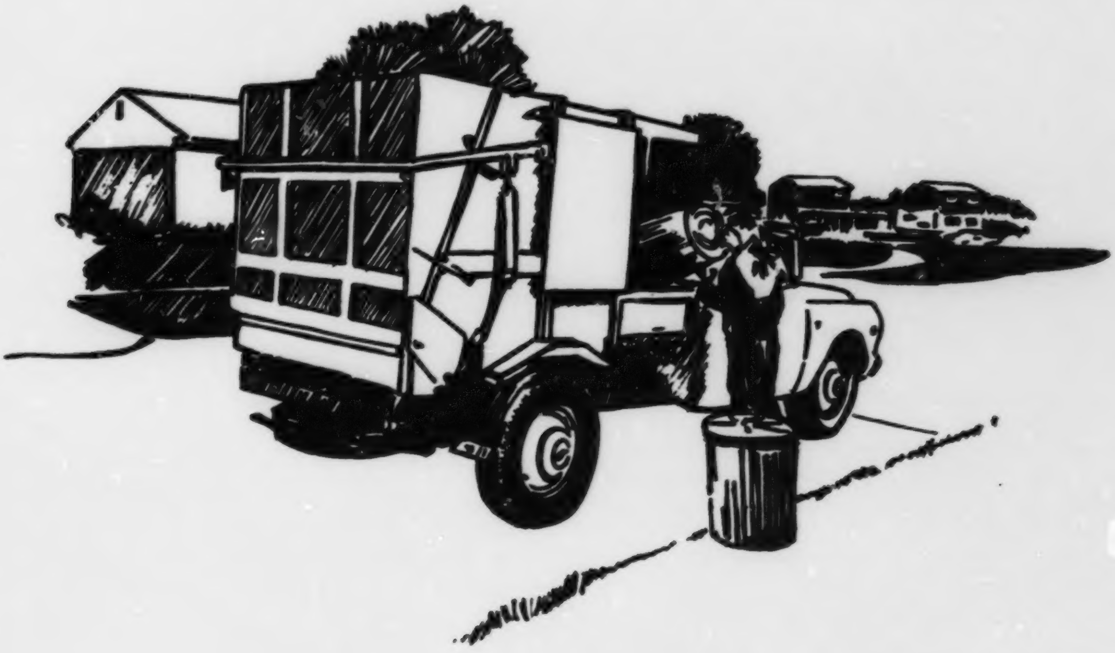


FIGURE 5.5b *Manual Pick-Up Side-Loader: Small capacity vehicles may be used to service very small cities or unincorporated places.*

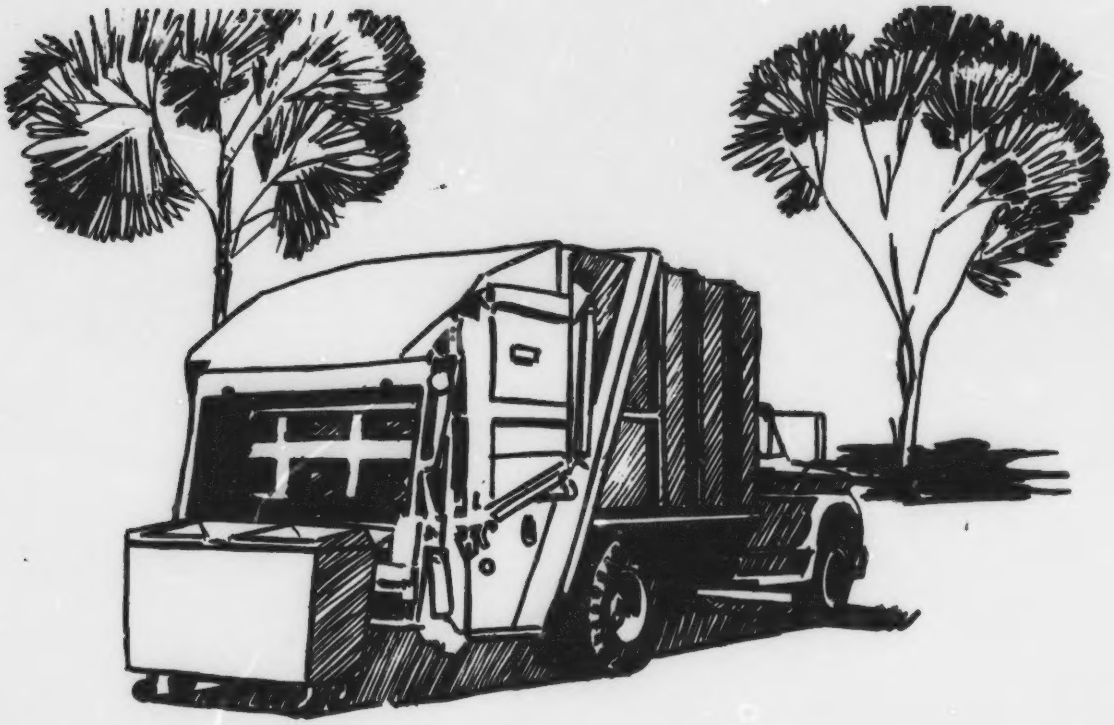


FIGURE 5.5c *Bulk-Container Rear-Loader: Bulk container pick-up is suitable for establishments, using small wheeled containers.*

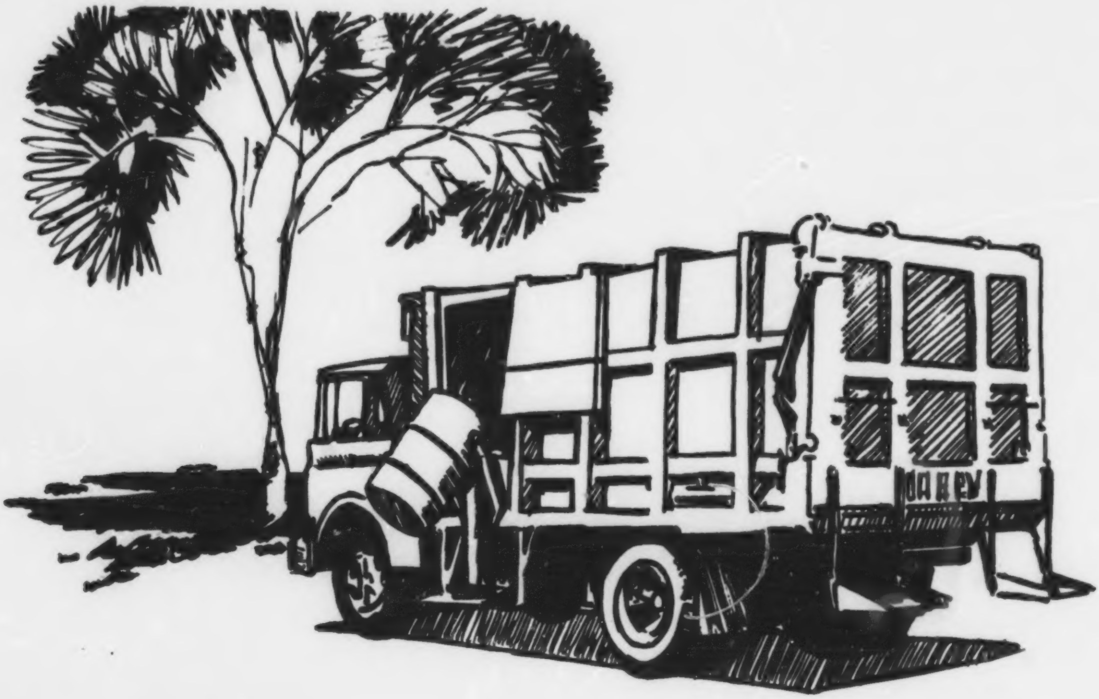


FIGURE 5.5d *Bulk-Container Side-Loader: The Barrel pick-up vehicle requires a crew to position heavy containers.*

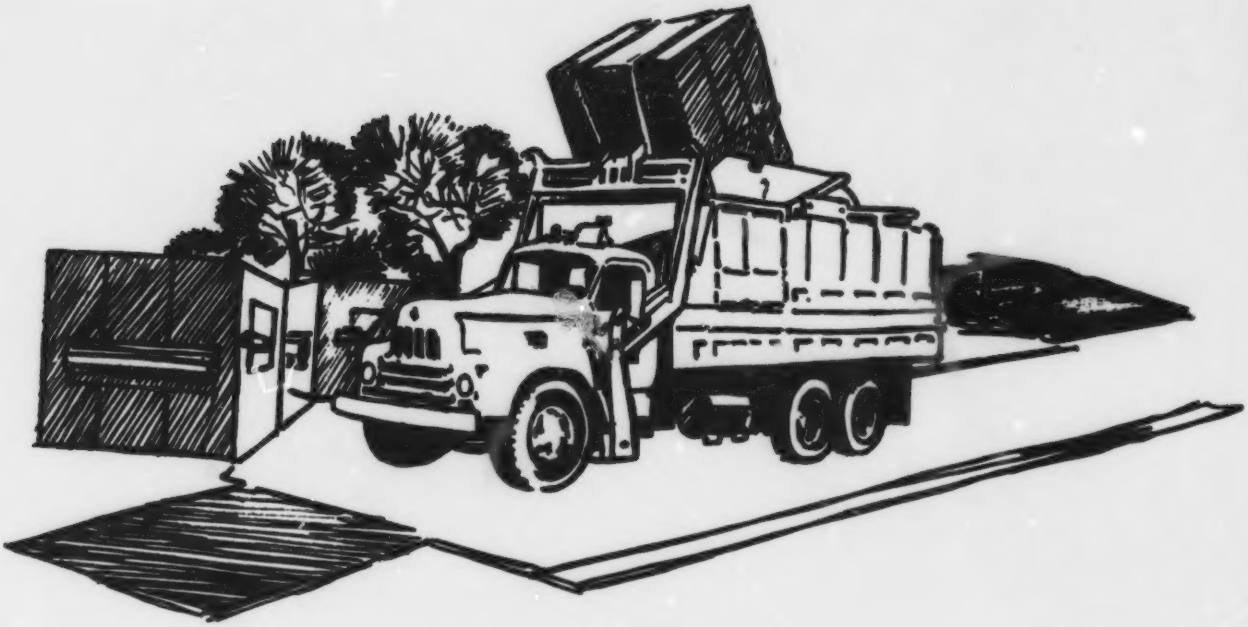


FIGURE 5.5e *Bulk-Container Front-Loader: A front loader, operated by only a driver, can empty an eight cubic yard container in about one minute.*

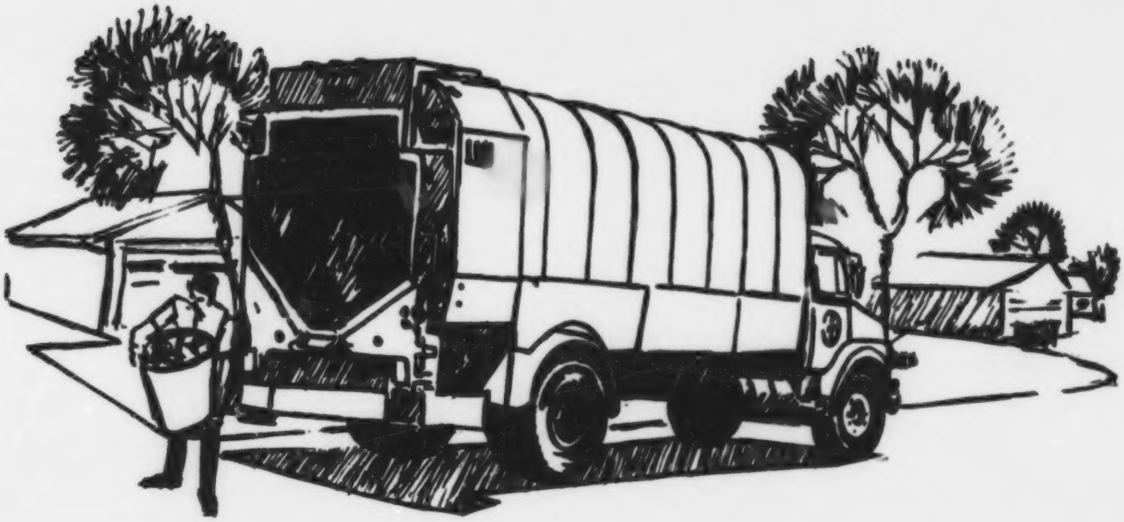


FIGURE 5.5f *KUKA "Shark": A rear-loading collection vehicle that uses a revolving drum method for packing solid waste.*

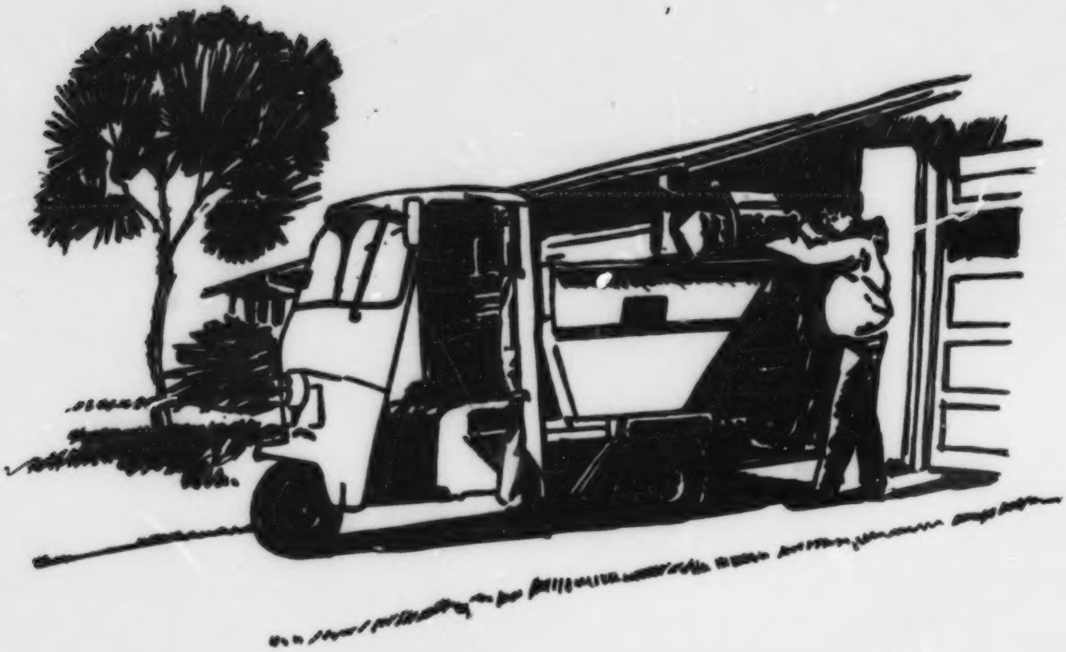


FIGURE 5.5g *Auxiliary Collection Vehicles: These vehicles are being used to replace large collection crews.*

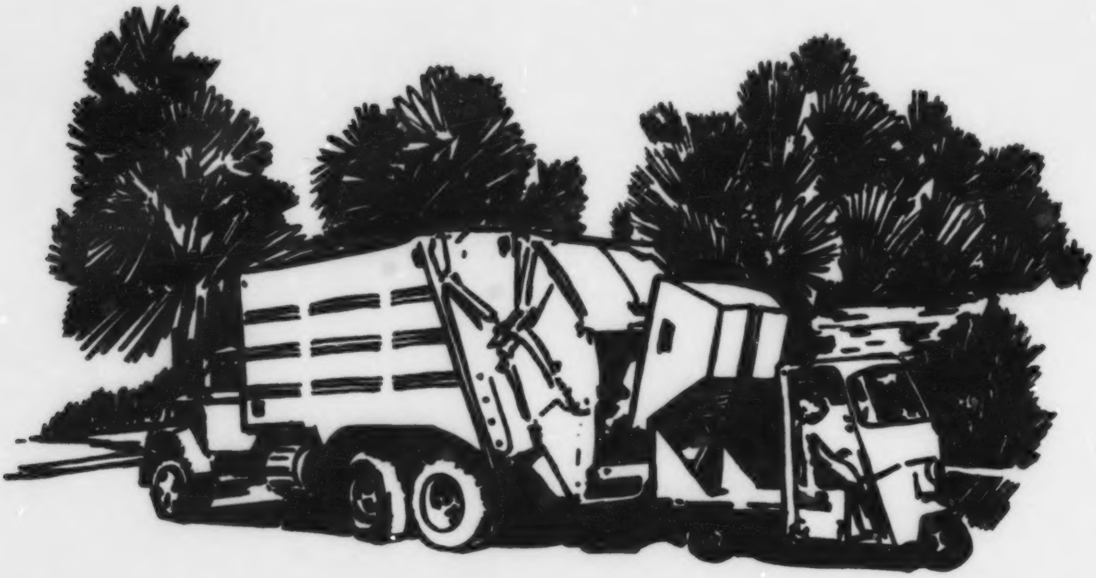


FIGURE 5.5h *Emptying An Auxiliary Collection Vehicle: Rear-loading collection packers receive solid waste.*

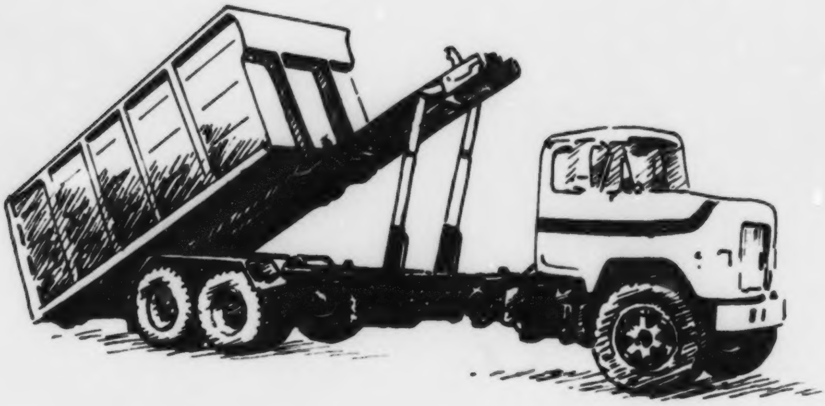


FIGURE 5.5i *Truck equipped to carry roll-off container (shown); this combination is effective in area-wide collection systems, and in certain industrial situations.*

Frequency and Routing

Collection frequency and routing are important in designing a system so that it can be operated with the best efficiency and least expense. Collection frequency may also be an important consideration from the standpoint of health. If significant amounts of putrescible wastes are stored, collection may have to be more frequent than if no putrescibles were present. Similarly it could be necessary to make more frequent collections in the summer months than in the winter months. For residential waste, which is predominantly nonputrescible, the most common collection frequency is once or twice weekly. On the other hand commercial collection. including restaurant wastes, tends to be much more frequent.

Routing collection crews so as to cause least overlap and wasted mileage is an important economic factor. For a small community without a large number of streets to cover, it is easy to design a route that is nearly optimum, and small inefficiencies may not be critical. But if a community has several collection crews active on every working day or a private collector has several hundred containers to collect, a substantial effort toward finding the best routes will be worthwhile.

An excellent summary of the factors which are of importance in designing and operating collection systems is given in the U.S. Environmental Protection Agency Publication, "Solid Waste Collection," from December, 1972.

Special Wastes

Wastes such as demolition materials, car hulks, dead trees, and toxic and hazardous (industrial) materials usually occur at random frequencies, and cannot be easily or safely handled with equipment designed for normal municipal wastes. Although such wastes may not constitute a large proportion of the total amounts handled, they can create serious problems if appropriate provisions for their handling are not made (Figure 5.6).

FIGURE 5.6 *Certain types of waste require special efforts and precautions in handling.*

Financing

At some point it is necessary to consider how to raise funds to support collection and transportation services. If the service is operated by municipal personnel it may be satisfactory to raise funds through general municipal taxes. Most often municipal services are only provided in areas where this alternative is practical. In cases where several municipalities desire to join in formation of a regional waste management system, the financing of costs through taxes may be more complicated. In cases where private contractors provide services charges are often made directly by the contractor to families, businesses, or industries served on a time period basis (e.g., monthly, annually), or municipalities may assume the expense and acquire funds from their tax bases through regular channels. Collecting funds through user charges is often more desirable than through general taxes since charges can be based on amount of waste generated and level of service received.

Status In Wisconsin

Private contractors carry a significant portion of the waste in Wisconsin. In early 1973, 273 of the 529 licenses for collection and transportation services were issued to private contractors; 256 were issued to municipalities. Table 5.1 shows this information by county along with numbers of open trucks and packer trucks used. Open trucks are used primarily for the transport of bulky wastes. The large number of open trucks used in Wisconsin includes 516 trucks operated by the State Department of Transportation. These are included in the Dane County figure.

Private contractors haul a greater fraction of total waste today than they did several years ago; this trend is continuing. Table 5.2 shows the occurrence of municipal and private collection systems in American cities in 1964. It can be seen from this table and from Table 5.1 that private contractor services are indeed increasing.

Special Aspects of Collection and Transportation

Special attention should be given to several components of collection and transportation systems which have become important in certain applications:

- containerized collection systems for rural areas.
- transfer stations.
- rail transportation of waste from large metropolitan areas.

The "green box" system of rural containerized refuse collection gained great national attention in rural Chilton County, Alabama, as part of a plan in the late 1960's to establish a single disposal site replacing the 93 scattered sites which previously existed in the county. The system derives its popular name from the 2-8 cubic yard green containers which are placed at various locations in the county, arranged so that no resident is unreasonably far from a container. Waste is placed in these containers by residents and removed every two days and taken to the county landfill site. A bulk-container frontloading packer truck (Figure 5.5e) is used to empty the containers.

In Wisconsin a number of rural collection services presently exist, based on the green box or small container system and on large 30-50 cubic yard boxes. An example is a private collection service which provides rural collection for several townships in Iowa, Grant and LaFayette Counties. This service is not part of a county-wide or regional disposal system as in Chilton County. Nevertheless, the present arrangement in Wisconsin has proved to be a financial benefit to small and sparsely populated communities as an alternative to the local dump.

TABLE 5.2

Incidence of Municipal and Private Contract Service for Collection and Transportation of Solid Wastes in American Cities, 1964

Population Group	Municipal or Contract	Number of Cities Reporting
1,000,000 and over	M	5
	C	1
100,000 to 1,000,000	M	69
	C	13
50,000 to 100,000	M	66
	C	29
25,000 to 50,000	M	134
	C	54
10,000 to 25,000	M	227
	C	88
5,000 to 10,000	M	124
	C	67
000 to 5,000	M	6
	C	6
Not stated	M	6
	C	1
Totals	M	637
	C	259
Overall Total	M & C	896

In several parts of the state large containers are used as collection points for waste from rural and suburban residents. They are generally open-top roll-on, roll-off containers approximately 25-60 cubic yards in size. The success of such services to date in Wisconsin suggests that county or regional waste collection and disposal services could be of benefit in many areas.

Transfer stations have come into use in recent years particularly in areas where large amounts of waste are collected and where wastes must be transported considerable distances. A transfer station is a facility where waste is transferred from small containers, usually collection vehicles, to large containers such as high capacity semitrailers. Depending on volumes of waste handled, the transfer station may range from a single stationary compactor unit or bulk container, which can be loaded onto a truck, to a sophisticated facility with dumping and loading bays, enclosure building, and auxiliary waste processing equipment. In Wisconsin, medium sized transfer stations have been operating in Milwaukee and Marshfield since 1971, and in Stevens Point since 1973. The Marshfield facility is shown in Figure 5.7.

TABLE 5.1

Summary of Data Pertaining to Collection and Transportation Services in Wisconsin, 1972

County	Number of C & T Services			Cities Served By:		Towns Served By:		Villages Served By:		Number of Packers		Number of Open Trucks		Containers
	Total	Munic.	Priv.	Munic.	Priv.	Munic.	Priv.	Munic.	Priv.	Munic.	Priv.	Munic.	Priv.	
		Service		Service		Service		Service		Service		Service		
Adams	4	1	3	0	0	0	8	1	0	1	1	0	2	0
Ashland	4	1	3	0	3	0	0	1	0	0	4	1	0	57
Barron	7	2	5	2	2	0	5	0	3	2	1	0	4	10
Bayfield	3	1	2	0	2	0	2	1	1	0	1	1	1	0
Brown	9	6	3	2	1	1	8	3	0	36	6	2	4	287
Buffalo	3	2	1	2	0	0	1	0	0	1	0	1	1	0
Burnett	2	0	2	0	1	0	0	0	4	0	2	0	0	40
Calumet	3	2	1	1	2	0	0	1	1	1	1	1	0	0
Chippewa	9	3	6	1	6	0	8	2	2	1	11	2	2	0
Clark	6	5	1	5	0	0	0	0	1	6	0	0	1	0
Columbia	9	5	4	3	2	1	8	2	1	5	3	1	6	30
Crawford	1	0	1	0	1	0	2	0	0	0	4	0	0	0
Dane	23	13	10	3	5	2	4	8	5	50	22	3	518+	107
Dodge	10	6	4	3	5	2	11	4	5	3	6	2	3	6
Door	2	1	1	1	0	0	0	0	1	2	2	0	0	0
Douglas	2	1	1	1	0	0	3	0	3	5	1	0	0	0
Dunn	6	2	4	0	2	2	1	2	1	0	3	2	2	95
Eau Claire	4	1	3	1	1	0	1	0	1	0	1	1	2	0
Florence	1	1	0	0	0	1	0	0	0	1	0	0	0	0
Fond du Lac	17	5	12	2	11	1	20	3	4	11	10	1	13	17
Forest	2	0	2	0	0	0	1	0	0	0	0	0	2	0
Grant	11	8	3	2	2	1	0	6	1	4	4	5	1	0
Green	6	5	1	2	0	1	0	2	1	2	1	6	0	0
Green Lake	6	3	3	3	1	0	4	0	0	3	3	0	2	0
Iowa	9	9	0	2	0	2	0	7	0	3	0	11	0	0
Iron	5	4	1	1	0	3	1	0	0	1	0	5	0	0
Jackson	7	6	1	1	0	3	1	4	0	3	0	4	1	0
Jefferson	13	4	9	4	11	1	7	2	5	3	18	0	3	351
Juneau	7	7	0	3	0	2	0	5	0	4	0	3	0	0
Kenosha	7	1	6	1	4	0	2	0	1	20	20	2	0	30
Kewaunee	4	4	0	2	0	0	0	2	0	3	0	1	0	0
La Crosse	3	0	3	0	4	0	6	0	4	0	18	0	2	0
Lafayette	4	2	2	0	4	0	9	2	1	1	3	1	0	44
Langlade	7	2	5	1	3	0	1	1	0	1	1	2	7	0
Lincoln	4	2	2	2	3	1	5	0	0	5	5	0	1	61
Manitowoc	10	2	8	0	8	0	0	2	1	1	12	1	6	0
Marathon	9	3	6	2	8	0	6	1	1	9	10	1	2	3
Marinette	12	9	3	2	2	4	4	3	2	7	0	3	4	0
Marquette	3	3	0	0	0	1	0	3	0	1	0	3	0	0
Menomonie	1	0	1	0	0	0	0	0	1	0	0	0	1	0
Milwaukee	24	15	9	11	15+	0	0	3	0	211	41	74	13	25
Monroe	6	4	2	2	1	4	3	2	1	2	2	8	1	0
Oconto	8	5	3	3	0	1	4	2	0	3	2	2	2	0
Oneida	7	1	6	1	2	0	7	0	0	3	2	0	4	0
Outagamie	15	9	6	3	14	0	8	6	0	21	16	3	13	358
Ozaukee	6	4	2	1	1	0	1	3	0	6	1	0	5	0
Pepin	2	0	2	0	1	0	2	0	2	0	1	0	2	0
Pierce	8	3	5	0	4	3	1	3	3	0	5	2	2	50
Polk	6	1	5	0	2	0	0	1	8	0	4	1	1	0
Portage	4	2	2	0	2	0	2	2	1	0	2	2	1	0
Price	5	5	0	2	2	4	2	2	1	2	2	5	1	0
Racine	10	2	8	2	11	0	13	0	2	35	14	5	6	0
Richland	6	4	2	1	1	0	0	3	0	2	1	3	2	0
Rock	17	5	12	4	14	2	5	0	0	10	6	4	7	5
Rusk	4	3	1	1	1	0	0	2	0	1	1	2	0	0
St. Croix	10	2	8	0	3	3	7	2	9	0	3	2	5	2
Sauk	11	7	4	1	1	1	6	6	6	3	6	5	1	0
Sawyer	2	0	2	0	1	0	3	0	0	0	1	0	1	0
Shawano	6	3	3	1	1	2	9	2	2	2	1	2	4	0
Sheboygan	18	10	8	3	4	0	7	7	5	29	16	2	2	31
Taylor	4	1	3	1	1	0	2	0	2	0	2	1	3	0
Trempealeau	7	4	3	3	5	0	1	1	2	1	4	3	0	0
Vernon	8	7	1	3	0	0	0	4	1	3	0	4	1	0
Vilas	4	1	3	1	0	0	6	0	0	1	2	0	2	0
Walworth	8	1	7	0	6	0	15	1	1	1	18	1	8	0
Washburn	4	1	3	1	2	0	9	0	4	1	1	0	4	0
Washington	15	7	8	2	5	2	9	4	6	13	16	1	4	0
Waukesha	14	2	12	0	19	0	5	2	32	1	55	3	28	166
Waupaca	10	2	8	2	7	0	4	0	1	1	5	4	4	0
Waushara	7	4	3	0	4	1	6	4	1	0	6	4	0	0
Winnebago	8	3	5	3	5	0	11	0	3	23	8	0	3	2
Wood	10	6	4	4	2	1	6	1	3	10	8	1	0	0
Total	529	256	273	111	231	53	283	131	147	581	426	210	721	1,777

Note: Data in this table come from information on file at the Wisconsin Department of Natural Resources.

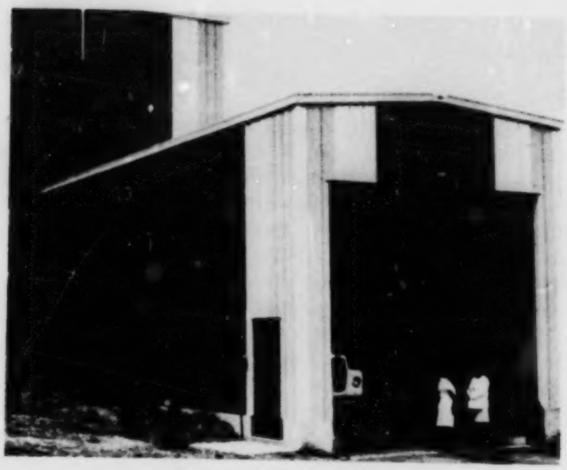


FIGURE 5.7 *External view of the transfer station facility in Marshfield, Wisconsin.*

Rail transportation of wastes has received attention primarily in very large metropolitan areas, where much waste is generated and where disposal sites are far from the waste sources. Rail transport of waste becomes especially attractive if large capacity sites are available. Cleveland, Ohio for example, is attempting to prove the practicality of rail hauling wastes to abandoned strip-mining sites, where landfilling of wastes could be a significant step in land reclamation. High compression waste baling can make rail hauling more attractive by providing increased weight-to-volume ratios for cost effective haul.

SUMMARY

Collection and transportation services represent major solid waste management cost items. In addition to providing for normal residential, commercial, and industrial waste a collection and transportation system should satisfactorily accommodate bulky items such as discarded appliances and demolition materials, as well as any toxic and hazardous wastes which are encountered.

Storage of wastes before collection is important. Improper storage can result in health, safety and esthetic problems, as well as inefficient and time consuming collection.

A variety of collection and transportation alternatives are available. Which ones will be chosen by communities, counties, regions, and industries depend upon the amount of service to be provided, the nature of the wastes to be handled, and available financial resources.

Once a basic collection and transportation system is chosen, financial benefits may be realized by giving attention to factors such as routing of collection vehicles, use of auxiliary equipment and adjustment of crew size. In some cases special considerations such as use of rail hauling or transfer stations may provide additional savings.

INTRODUCTION

Solid waste processing involves changing the physical or chemical characteristics of solid waste by mechanical, chemical or biological processes. Processing can take place at several points in a solid waste management system.

Typical on-site processing equipment includes garbage grinders, stationary compactors, home compactors, and small incinerators in the 500 pound per hour range.

Off-site processing facilities include large incinerators, composting plants, hydropulping operations, balers, and hammermill facilities.

The major reasons for considering solid waste processing are to:

1. reduce waste volume
2. reduce size of waste particles
3. change from a dry form to a wet form (pulp)
4. stabilize the putrescible portion of the waste
5. prepare the waste for resource recovery activities
6. separate the waste into different components
7. extract certain materials from the solid waste.

Incineration, milling, and baling are examples of processes that are used for reducing the space required for the disposal of solid waste.

Milling and baling are used to reduce the volume of solid waste. Milling reduces large pieces into smaller ones. Car hulks are milled partly to produce the small pieces of metal that can be handled by other processing methods. Baling is used to reduce the physical size of car hulks and other solid waste, to provide a higher density for more economical transportation.

Hydropulping is used to change dry solid waste into a slurry form, which facilitates further processing and allows the waste to be handled in a pipeline system. Such a system could be used, for example, for in-house collection and handling of hospital wastes. Hydropulping is used in the Black-Clawson resource recovery system, both for transporting purposes, and to facilitate the separation of wastes into recoverable components.

Copper wire, covered by various insulating materials, is processed by several methods. The most common is incineration. Other methods include milling (following cryogenic treatment), stripping, and crushing.

A number of more exotic processes, such as pyrolysis and fluidized beds, are being developed to extract heat energy, chemicals, and gases from solid waste for fuels. Processing for extraction of oil, yeast, protein, and other materials is being investigated on a laboratory scale.

It should be kept in mind that processing equipment is only one part of solid waste management. In every process, there are solid wastes on which the process cannot be used, and residues remaining after processing. Both of these must ultimately be disposed of on the land.

Composting has been a traditional processing method used to convert the biodegradable portion of solid waste to a more stable form.

A wide variety of processing equipment, such as shears and balers, has been used in the salvage and processing industry to convert cars and other recoverable items into salvageable forms. Such processing machinery as magnetic separators, air separators, hammermills, and screens are being used to process solid waste into recoverable material. Incineration has long been used to convert solid waste to energy for heat and electric power recovery.

The section on processing will mainly include discussion of off-site incineration, baling, and milling, as they are presently most important to solid waste management in Wisconsin. Additional information on processes that may become more important in the future, as recycling becomes more prominent, is discussed briefly in other sections.

Automobile processing equipment is discussed at some length in this section as the automobile hulk has, until the last few years, presented an almost insurmountable technical and economic problem in Wisconsin.

INCINERATION

Historical

The first crude incinerator was built in 1874 in England, to handle municipal refuse. The United States was quick to follow and built a municipal refuse incinerator in 1885.

A number of significant developments in incinerators took place in the late 1800's and early 1900's. The principle of forced draft was used to increase the rate of combustion. This was first used in England around 1890. In 1893 the design of a double fire-box type incinerator was introduced by Mr. S. M. Dixon. In 1901 the drying grate was used to enhance the combustion process.

Early incinerators suffered from a number of operational weaknesses. Many were improperly designed and suffered from a lack of construction details. Unskilled operators were unable to control the combustion process. Incomplete combustion processes led to smoke and odor problems. It was not until after World War II that modern incinerator technology was developed.

Since World War II, and particularly in recent years, the incinerator has been markedly influenced by the changing character of solid waste and the need for more efficient operations. Developments such as continuous feeding, mechanical stoking, mechanically controlled overfire air, facilities for fly ash removal, systems for continuous quenching and discharge of incinerator residue, the use of sectionally supported walls and hung arches with high quality refractories, and the use of travelling grates have made possible the installation of larger incinerators, improved combustion and increased operational efficiencies.

As we enter the environmental age the incinerator is undergoing new changes and technological developments. Changes to deal with air pollution and resource recovery are being made in the design of incinerators. Developments such as water walls, combustion in fluidized beds, high temperature incineration, and energy recovery indicate future trends.

However, before we can evaluate these future trends, or the present status of incineration in Wisconsin, we must examine the role incineration plays in the solid waste management picture. In addition, we should examine the present objectives of incineration.

Incineration As A Process

Incineration is a processing technique and not a method of final disposal. In the past the objectives of incineration have been to reduce the volume of municipal refuse and to convert combustible waste to a noncombustible residue.

From Figure 6.1, it is apparent that only about 80% of municipal waste can be processed at an incinerator. A significant fraction of this remains as residue to be disposed of. Overall, municipal waste can be reduced about 60% by weight through incineration.

Along with weight reduction, volume reduction is a characteristic of the incineration process. The volume of municipal solid waste to be incinerated can be reduced by 80 to 90 percent. The compaction of incinerator residue can result in further volume reduction. Solid waste residue coming from an incinerator may occupy only 4 to 10 percent of its original volume in the final disposal method. The composition of typical residue from an incinerator is shown in Figure 6.2.

Roughly one-half of the solid waste in a metropolitan area is combustible while the portion originating from homes is two-thirds combustible by weight. Future changes in refuse composition will certainly affect the process of incineration. Here forecasts of these changes and estimates of how they will affect the process of incineration are given. Table 6.1 indicates what some of the changes may be.

TABLE 6.1

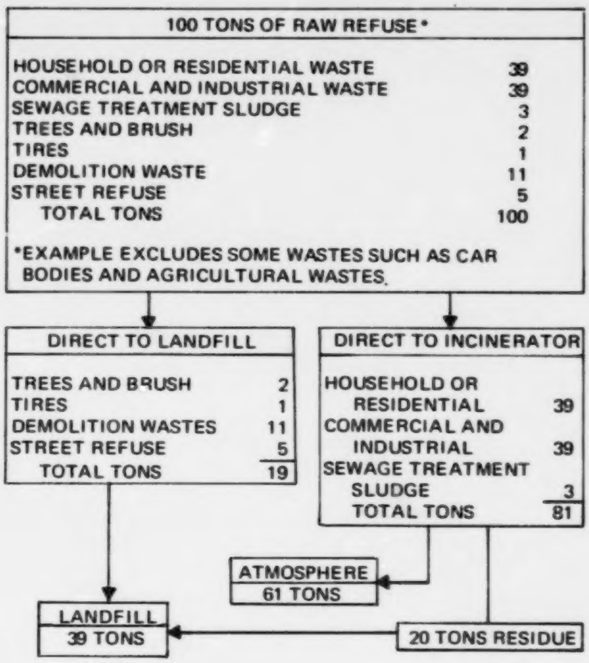
Refuse Composition and Projected Annual Increases

	Composition	Annual Increases
Glass	10%	3–4%
Metal	10%	3–4%
Paper	50%	4–5%
Plastic	4%	10%
Leather & Rubber	2%	3–4%
Textiles	3%	4%
Wood	3%	1%
Food Wastes	18%	1–2%

Source: American City.

FIGURE 6.1

Material Flow Pattern for Solid Waste, with Incineration Program


100 TONS OF RAW REFUSE*
HOUSEHOLD OR RESIDENTIAL WASTE 39
COMMERCIAL AND INDUSTRIAL WASTE 39
SEWAGE TREATMENT SLUDGE 3
TREES AND BRUSH 2
TIRES 1
DEMOLITION WASTE 11
STREET REFUSE 5
TOTAL TONS 100
*EXAMPLE EXCLUDES SOME WASTES SUCH AS CAR BODIES AND AGRICULTURAL WASTES.
DIRECT TO LANDFILL
TREES AND BRUSH 2
TIRES 1
DEMOLITION WASTES 11
STREET REFUSE 5
TOTAL TONS 19
DIRECT TO INCINERATOR
HOUSEHOLD OR RESIDENTIAL 39
COMMERCIAL AND INDUSTRIAL 39
SEWAGE TREATMENT SLUDGE 3
TOTAL TONS 81
ATMOSPHERE 61 TONS
LANDFILL 39 TONS
20 TONS RESIDUE

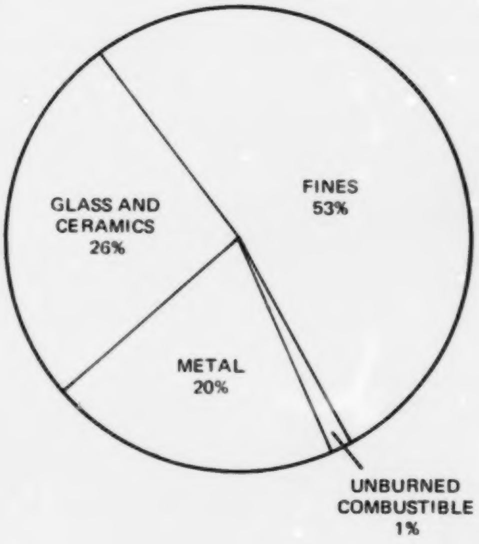


FIGURE 6.2 *Composition of Incinerator Residue*

Cost of Incinerators and Incineration

The costs for an incinerator will vary depending on the quantity and type of equipment and facilities in the plant. An excellent discussion on costs is given in ***Municipal Refuse Disposal.*** Costs are of two types: those related to ownership and those related to operation. Ownership costs are derived from the capital costs of financing the incinerator, and are usually paid off through depreciation and interest charges. Financing the construction of an incineration plant usually requires a bond issue. Operation costs are directly or indirectly related to operation and maintenance of the facilities.

Figure 6.3 shows how construction costs have been increasing with time in the past decade. A breakdown of cost by major elements is given in Figure 6.4. These costs vary primarily because of:

1. Site preparation peculiarities and foundation conditions.
2. Special requirements, including air pollution control equipment and esthetics.
3. Geographical differences in costs of labor and materials.
4. The extent to which structures must be enclosed because of weather conditions and the need to control nuisances.
5. Special features, such as steam and power generation equipment, and the degree of automation used.
6. The operating schedule–the relationship between the number of hours of plant operation and the rated 24-hour capacity.
7. Provisions for expansion included in original buildings.
8. The extent to which more costly equipment and materials are used for the purpose of reducing maintenance and repair costs.
9. Size of the plant.

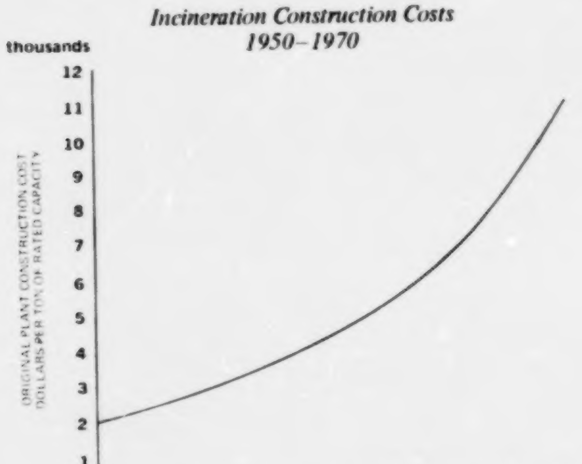


FIGURE 6.3

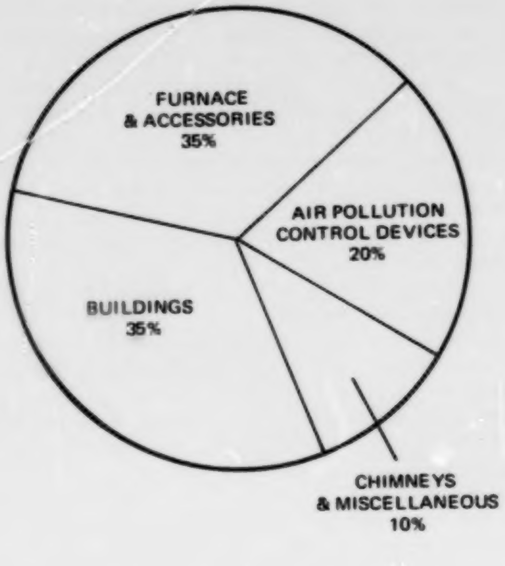


FIGURE 6.4 *Incinerator Cost Breakdown*

Operational costs will vary in accordance with differences in the amount and types of pollution control, equipment, labor rates, costs of utilities, residue disposal, and the degree of automation of the plant. Operational costs vary from $3.00 to $10.00 per ton of solid waste processed. The total cost of processing solid waste at an incineration plant will vary from $5.00 to $15.00 per ton, and with more stringent air pollution control rules, costs tend to increase. It should be noted that as incineration is only a processing method, no mention has been made of the final disposal costs of the residue. This cost may vary from $.50 a ton to $2.00 a ton.

Air Pollution Control

As we move into a new age of environmental awareness, considerations must be given to air pollution and resource recovery. There are two basic groups of air pollution control equipment for the municipal refuse incinerator. One group can be labelled "dry systems" and includes subsidence or settling chambers, mechanical cyclones, electrostatic precipitators, and bag filters. Dry systems are effective only on particulate matter. The "wet system" group includes wetted impingement baffles and high efficiency wet scrubbers. Wet systems will have some effect on the removal of water soluble gaseous pollutants.

In the operation of the subsidence or settling chamber the velocity of the gases is reduced by enlarging the gas flow area. This increases the retention time of the gases, thus allowing the larger particles to settle. In a mechanical cyclone the particulate matter is thrown to the periphery of the cyclone by centrifugal force. The particulate matter is allowed to settle at the periphery and is then removed. In the operation of the electrostatic precipitator, particulate matter is electrically charged and attracted to plates of opposite charge. The particulates are then collected in a hopper. *Bag filters function* by trapping the particulates on a filter medium.

Wetted impingement baffles function by causing flue gas to follow a tortuous path through the wetted baffles. Particulates are thus trapped in water and separated from the flue gas. High efficiency wet scrubbers function in much the same way; particulate matter is trapped in the scrubbing liquid.

In discussing air pollution control equipment, reference is frequently made to air pollution control regulations. The regulation for Wisconsin incinerators constructed after April 1, 1972 and rated at 4,000 pounds of waste per hour or more, is not to exceed an emission of .15 pounds of particulate per 1,000 pounds of exhaust gas. It is doubtful if any of the air pollution devices mentioned, other than the electrostatic precipitators and bag filters, could meet this standard. It therefore appears that the trade-off in meeting environmental quality will have to be a more expensive form of air pollution control.

Resource Recovery

The recovery of resources can be divided into two areas; the recovery of energy such as heat or the recovery of materials such as metals. The excess heat from the combustion process of incineration may be used to generate electricity or steam. The ashes may be sifted and separated to yield ferrous metals and glass. This type of operation would conserve mineral resources. Other incineration processes could produce a fuel or a sterile ash that could be used in the construction of roads.

Methods of resource recovery as applied to incinerators are quite varied. The important fact is that the revenue claimed by resource recovery can be used to offset the cost of the incineration process.

The Present Status of Wisconsin Incinerators

Figure 6.5 indicates present status of municipal incinerators. Only one incinerator in Wisconsin is licensed to burn municipal solid waste. Thirteen others are operational but are unlicensed and are required to be upgraded to meet air quality standards, or to be closed. Of these fourteen incinerators, three basic types exist. One type includes large, relatively modern, continuous feed incinerators such as the ones located in Sheboygan, Oshkosh and Waukesha. In the smaller communities there appear to be two types. One is a continuous feed incinerator with little automated equipment. The other is a batch feed incinerator that has no grates. At present, no plans or projects are underway for the construction of any larger municipal solid waste incinerators in Wisconsin. Some small communities are investigating the smaller type incinerators as possible means of solid waste processing. Since incinerators constructed in the future would be required to meet air pollution control rules, substantial money would have to be invested in air pollution control equipment. This would raise the cost of incineration, making it economically infeasible in many cases.

New Developments

A short overview of some processing techniques follows. This overview points out the future trends of incineration and lists some of the alternatives for Wisconsin in the future. A more detailed explanation of any one particular process can be found in the references listed at the end of this report.

The use of waste heat boilers to generate steam from the products of combustion at municipal incinerators is not new. A number of such installations have been made in this country. Most of these installations have been of low efficiency. Of particular interest are the steam generating incinerators of Montreal and Chicago.

The Montreal and Chicago incinerators have capacities for solid waste processing of 1,200 tons per day and 1,600 tons per day, respectively. Both plants have been designed to meet environmental standards. In the Montreal plant the steam generating system consists of boilers heated by gases given off in combustion. The boilers serve two complementary purposes: they trap waste heat and convert it to steam, and they cool the flue gases sufficiently to allow the use of electrostatic precipitators for the recovery of fly ash. The boiler has a rated capacity of 100,000 pounds of steam per hour (500 degrees F @ 225 psi). The boilers for the Chicago incinerator are the water wall type with a capacity of 110,000 lbs. of steam per hour. Condensers are used at both incinerators to dispose of the excess steam.

There is little question in the minds of plant engineers that steam-generating incinerators are the way of the future. With the recovery of steam it has been estimated that the cost of the Montreal plant may be as low as $3.50 per ton of waste.

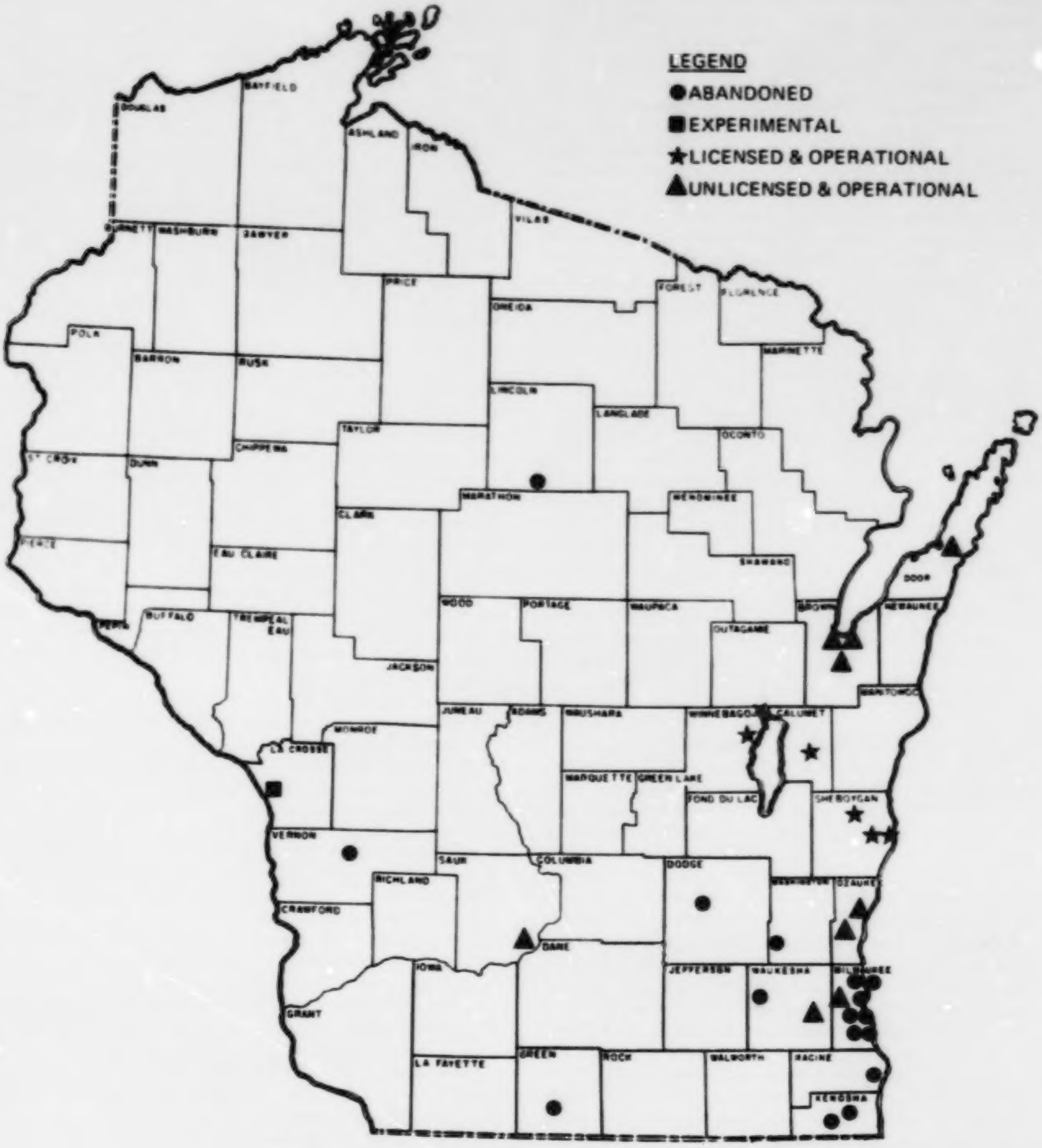
In Nashville, Tennessee energy recovery has been expanded to cover projects such as providing district heating and cooling to the central city area buildings, recovering energy from combustion of all solid waste not recycled for other purposes, providing for major ferrous material recycling from incinerator residue, and providing an economically favorable system with acceptable environmental impact on the community.

The milling (shredding) of refuse prior to incineration is being examined in Akron, Ohio. As it arrives, waste is dumped into a storage pit. From there it is transported to shredders. After shredding, the waste is magnetically separated to remove ferrous metals. Density separation is also employed to remove other metals and glass. The remainder of the shredded waste is then transported to boilers for semi-suspension firing.

Shredding has some significant advantages which warrant its consideration in a project including incineration:

1. Permits acceptance of a wider range of waste including bulk waste, reducing problems of control of waste input.
2. Eliminates the crane.
3. Provides a more uniform fuel to the furnace.
4. Grate configuration is simpler, less expensive and easier to maintain.
5. Excess air requirements can be lower with shredded waste, precipitators can be smaller and efficiency is higher.
6. Boiler type corrosion from reducing atmospheres

FIGURE 6.5 *Status of Incinerators in Wisconsin*


LEGEND
● ABANDONED
■ EXPERIMENTAL
★ LICENSED & OPERATIONAL
▲ UNLICENSED & OPERATIONAL
DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
BURNETT
WASHBURN
SAWYER
PRICE
ONEIDA
FOREST
FLORENCE
POLK
BARRON
RUSK
MARINETTE
LINCOLN
LANGLADE
TAYLOR
OCONTO
ST CROIX
DUNN
CHIPPEWA
MARATHON
MENOMINEE
CLARK
PIERCE
EAU CLAIRE
SHAWANO
DOOR
PEPIN
BUFFALO
TREMPEALEAU
WOOD
PORTAGE
WAUPACA
OUTAGAMIE
BROWN
KEWAUNEE
JACKSON
MANITOWOC
JUNEAU
ADAMS
WAUSHARA
WINNEBAGO
CALUMET
MONROE
LA CROSSE
MARQUETTE
GREEN LAKE
FOND DU LAC
SHEBOYGAN
VERNON
SAUK
COLUMBIA
DODGE
WASHINGTON
OZAUKEE
RICHLAND
CRAWFORD
DANE
IOWA
JEFFERSON
WAUKESHA
MILWAUKEE
GRANT
LA FAYETTE
GREEN
ROCK
WALWORTH
RACINE
KENOSHA

should not be encountered with shredded waste firing.

7. Separation of recyclable components is facilitated.

8. Residue is more uniform and better suited for fill.

Another method of energy recovery from solid waste is to shred it to a uniform size and feed it as supplemental fuel in a power plant. This is being done in St. Louis, Missouri. A maximum of 600 tons/day (16 hours) can be processed at that particular plant. The refuse is mixed with coal at a 10:1 ratio.

A similar approach to the one in Akron, Ohio is the CPU-400 system. Refuse is shredded and then passed through an air classifier to effect materials separation. The remaining portions are dried and used as a source of energy. The material is combusted in a fluid bed of sand. Gas turbines of 15,000 kilowatts could be used in the process. The advantage of this system is that it is not limited to domestic refuse.

Pyrolysis, which is a well developed industrial process, is being given consideration as a technique to upgrade a wide range of solid wastes into quality fuels. In this process the refuse is sealed in a container and heated without excess air; the resulting pyrolyzate is recovered as a nondistillable melt.

Another thermal reduction process is the torrax solid waste conversion system. The primary objective of this system is to convert mixed refuse, through the use of a high temperature slagging-type incinerator, into a clear, inert, glassy-type, aggregate residue. To do this a temperature of 3,000 degrees F. must be maintained. The key points of this system are: (1) very high volume reduction, (2) production of a clear inert residue with by-product possibilities, (3) few mechanical moving parts, (4) low pollution potential.

Other new developments for Wisconsin are the use of air curtain destructors for wood wastes and waste chemical incinerators for toxic and hazardous substances.

Almost all of the new developments that have been indicated here have little information available on their capital and operation costs. Experience with these developments over a period of years will be needed to adequately evaluate economic feasibility.

Summary

With the mushrooming problems of solid waste disposal and recent technological advances, incineration, as a process, is being given careful consideration.

The following list of considerations was taken from *Municipal Refuse Disposal*, and best summarizes the subject.

Advantages

1. Much less land is required than for disposal in landfills. If there are insufficient sites available for landfills within economic haul distances, an incinerator in a strategic location may aid in producing the most economical total system of collection and disposal.

2. A central location for an incineration plant is possible. A carefully operated plant in a well designed building that has well landscaped grounds is acceptable in many neighborhoods, and so site selection may not be as difficult as it is for some other disposal methods.

3. An incinerator can produce ash residue that contains a negligible amount of organic materials and thus is relatively nuisance-free and more acceptable as fill material.

4. The modern incinerator can efficiently burn combustibles to ash, and can even reduce the bulk of the noncombustible components of mixed refuse. (Special processing or handling is required for objects that are very large, those that cause excessive smoke, and those that are explosive.)

5. An incinerator is not directly affected by climate or unusual weather.

6. An incinerator is flexible. It can be readily adjusted to handle normal fluctuations in quantity and condition of refuse received. A plant operating 16 hours a day can be put on a 24-hour basis, for example, or the rate of firing can be varied within limits.

7. It may be possible to get some incidental income from incinerator operations to partially offset operating costs. Waste heat can be used to generate salable steam or electric power; separable metals can be recovered and sold; residues may have some value for filling purposes or as a construction material, if they are well burned or reduced to slag form. In some cases it may be feasible to provide incinerator service for a group of communities, to industry, and to private collectors on a utility basis. Rates can then be set to completely support the operation.

Disadvantages

1. An incinerator requires a large capital investment. Increasing public concern with elimination of environmental pollution is requiring higher performance standards, achievable largely only by design refinements and additional equipment, all of which add to capital cost.

2. Operating costs are relatively high. Highly skilled employees are required to operate, maintain, and repair an incinerator. Maintenance and repair costs are high. Equipment and machinery are frequently damaged by wires, tramp metals, and fusible, abrasive, and explosive materials in the refuse. The combination of large capital investment, higher labor costs, and costly maintenance and repairs can produce a cost per ton for refuse disposal greater than for other acceptable methods.

3. The economic justification for refuse processing by incineration often depends heavily on strategic location of the plant to permit substantial savings in collection costs. Acquisition of an acceptable site may be difficult because this often means locating in a densely populated area, where refuse operations in any form are offensive to many people. Associated truck traffic may be a significant nuisance and hazard factor, particularly in residential neighborhoods.

4. Incineration is not a complete disposal method. Ash and other residue from the burning process, including fly ash, must be disposed of on the land.

COMPOSTING

Introduction

Composting is a biological degradation process by which organic materials are converted into a nuisance-free, humus-like material. Composting has been practiced for centuries; Asiatic farmers have long buried organic materials, and after several months reclaimed a compost produced by anaerobic (absence of air) decomposition. The anaerobic process proved to be undesirable, as unpleasant odors of hydrogen sulfide, mercaptans and some other gases were generated. The dissatisfaction with this method eventually lead to the wide use of the aerobic decomposition process, which when properly operated produces few odors.

In the aerobic process, material is continually exposed to the air, and as a result the microorganisms which thrive on air and inhabit the organic material, are able to produce enough heat and activity to ingest large amounts of organic materials. During this process the organisms break down complex organic substances into elements which can more readily contribute to soil functions during plant growth. High temperatures are reached (150–180 degrees F.), destroying most pathogenic bacteria and insect larvae, while promoting rapid and high quality composting.

In contrast, the anaerobic process has low temperatures, is very slow, and allows pathogens and insect larvae to survive. Primarily for this reason most composting today is done by an aerobic process.

Aerobic decomposition was first used in large scale operations in this century in India. Sir Albert Howard developed a process to stabilize agricultural wastes aerobically by piling straw and animal manure in layers thereby allowing air to penetrate the piles and promote degradation. This technique was proven to work for agricultural wastes, and soon spread worldwide. This method was found to work not only on agricultural wastes but on household refuse, sewer sludge, and other organics.

In the last few decades composting has undergone rapid changes as a solid waste management alternative. It has at times been presented as a complete solid waste management system and one which could produce a financial profit from sale of compost. In some instances, facilities have been constructed on a large scale without proper analysis of economic or process conditions. As a result several composting facilities in the U.S. have ended in failure. Detailed investigations are important in determining economic, technical and market viability of compost operations in any area. (Figure 6.6.) In addition, composting should be considered as one of many possible solid waste management alternatives. While it may not result in financial profit, composting is an environmentally beneficial system that can relieve the burden on other methods of solid waste management.

European Experience

Europe has been a leader in composting processes as it has been in other solid waste management areas involving processing. Many experts have studied the methods and techniques of these successful plants and have concluded that geographic region and type of agriculture in the area play important roles in determining the economic viability of composting. European plants are many times owned by the public or communities and a dumping fee is charged. They often combine solid waste and sewerage sludge in a single composting operation and then provide the composted material to the public.

Basic Biological, Chemical, and Mechanical Elements of Composting

One of the most important factors in designing a compost process is the rate and type of aeration system used. Only through the presence of an adequate air supply can aerobic conditions be ensured. The air rates must be high enough to remove all exhaust CO_2 gases and return adequate supplies of fresh oxygen to the microbes. Forced air can also cut the fermentation time from about 18-20 days, to 4-6 days.

Another factor is moisture content. The microorganisms which ingest the organic materials need high levels of moisture to maintain cell membranes and keep the process in operation. Ideally, moisture content is 50-60% by mass with a 30% minimum level to maintain microbe life. In order to maintain such high levels of water, sprinkler systems are usually included in composting processes.

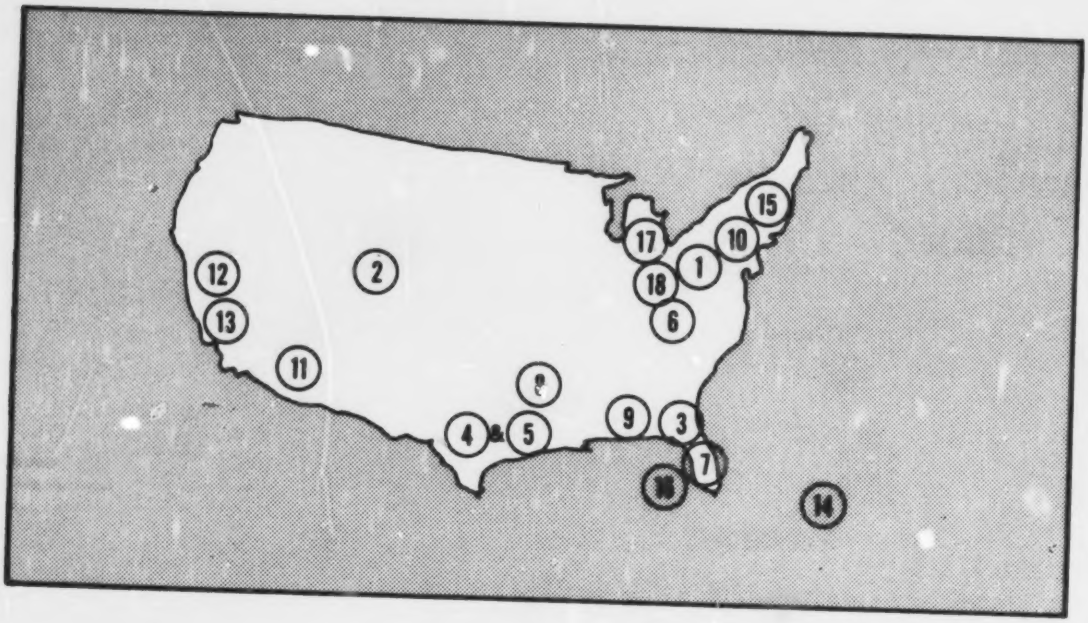
The pH of a composting mixture is also important, as highly acidic or basic mixtures can cause the microorganisms to die.

Chemical composition of the material to be composted must be controlled. The carbon to nitrogen ratio is the important chemical control in the compost process. It is used to gauge the utility of compost as a soil conditioner for agricultural use. In normal raw refuse the C/N ratio is about 30/1 and as it is composted the ratio becomes about 20/1, which is good for a soil conditioner. Some refuse, however, is chemically deficient and must have chemicals (nitrogen) added to maintain proper C/N levels. The easiest way found to convert chemically lacking refuse is to add sewerage sludge, which has high N values.

Reaction temperatures are another important consideration. Natural process temperatures range from 140-160° F., and at these high temperatures reactions take place sufficiently in 4-6 days. Also high temperatures destroy pathogens and insect larvae and preserve the basis of the aerobic process.

Finally, particle size affects the rate of composting, the texture of the final product, and workability during composting. Smaller particles have a larger surface to weight ratio and allow maximum bacterial contact. However, if particles are too small the void ratio becomes less, and aeration is more difficult to properly achieve. Particles

FIGURE 6.6
Status of United States Composting Plants



	Location	Closed	Opened	Tons/Day Capacity	Process	Waste Type
1	Altoona, Pa.	Operating	1951	45	Fairfield-Hardy	Garbage, Paper
2	Boulder, Colo.	1971	1965	100	Windrow	Mixed Refuse
3	Gainsville, Fla.	1971	1968	150	Metrowaste	Mixed Refuse, Digested Sludge
4	Houston, Texas	1970	1966	360	Metrowaste	Mixed Refuse, Raw Sludge
5	Houston, Texas	1966	1966	300	Snell	Mixed Refuse
6	Johnson City, Tenn.	1970	1967	52	Windrow	Mixed Refuse, Raw Sludge
7	Largo, Fla.	1967	1963	50	Metrowaste	Mixed Refuse, Digested Sludge
8	Norman, Okla.	1964	1959	35	Naturalizer	Mixed Refuse
9	Mobile, Ala.	1971	1966	300	Windrow	Mixed Refuse, Digested Sludge
10	Brooklyn, N.Y.	Operating	1971	150	Varro	Mixed Refuse
11	Phoenix, Ariz.	1965	1963	300	Dand	Mixed Refuse
12	Sacramento, Calif.	1963	1956	40	Dand	Mixed Refuse
13	San Fernando, Calif.	1964	1963	70	Naturalizer	Mixed Refuse
14	San Juan, P.R.	1972	1969	150	Fairfield-Hardy	Mixed Refuse
15	Springfield, Mass.	1962	1961	20	Frazer-Eneson	Garbage
16	St. Petersburg, Fla.	1971	1966	105	Naturalizer	Mixed Refuse
17	Williamston, Mich.	1962	1955	4	Riker	Garbage, Raw Sludge, Corn Cobs
18	Wilmington, Ohio	1965	1963	20	Windrow	Mixed Refuse

DATA ABOVE UPDATED FROM, "COMPOSTING OF MUNICIPAL SOLID WASTES IN THE UNITED STATES," 1971, TABLE 4.

From: The Problem of Solid Waste Disposal

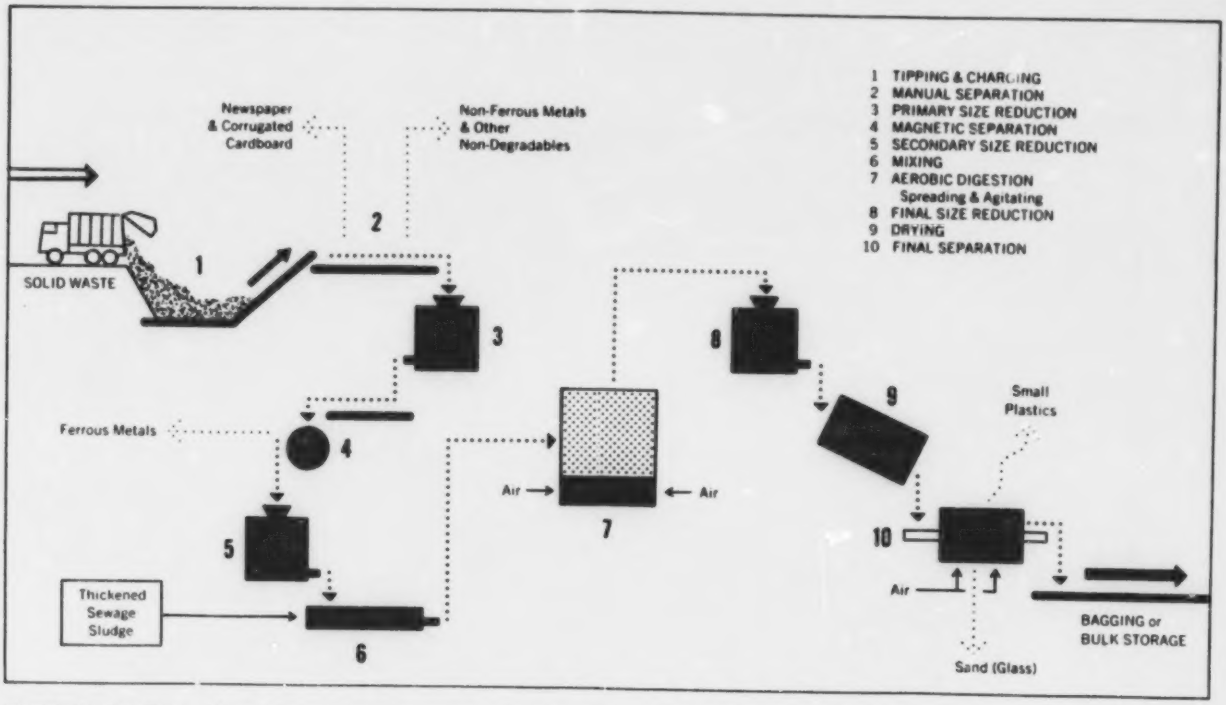

1 TIPPING & CHARGING
2 MANUAL SEPARATION
3 PRIMARY SIZE REDUCTION
4 MAGNETIC SEPARATION
5 SECONDARY SIZE REDUCTION
6 MIXING
7 AEROBIC DIGESTION
Spreading & Agitating
8 FINAL SIZE REDUCTION
9 DRYING
10 FINAL SEPARATION
Newspaper & Corrugated Cardboard
Non-Ferrous Metals & Other Non-Degradables
SOLID WASTE
1
2
3
Ferrous Metals
4
5
Thickened Sewage Sludge
6
Air
Air
7
8
9
Small Plastics
10
Air
Sand (Glass)
BAGGING or BULK STORAGE

FIGURE 6.7 *Basic Plant Layout for Composting Facility From: The Problem of Solid Waste Disposal*

should never be made so fine as to create dust problems during operation or application.

Careful considerations must be given to all these factors when considering the viability of composting operations. A variety of composting operations have been developed, yet all employ the basic elements discussed above.

Composting Equipment

There have been many different aerobic composting systems developed. Fundamentally, they differ only in mechanical processes for the actual composting and in the air delivery systems. In general they all utilize the same basic layout for plant operations, Figure 6.7 and produce the same final product. The basic steps as shown in the diagram are: handling, separations, salvage, grinding, addition of chemicals or sludge, digestion, curing, finishing, and storage. A number of composting processes most popular today are briefly discussed in Table 6.2. Each one of these can be categorized according to these mechanics:

1. Windrowing (open piles)
2. Mechanical processes
   a. continuous
   b. stationary (intermittent burning)

Characteristics of each system must be carefully examined in regard to the particular desired application and end product.

Uses and Markets

Fertility of the land is related directly to the amount of organic matter present in the soil, and particularly to the nitrogen content. Organic matter includes many things both living and dead, and is a prime source of nutrient supply for plant growth. A typical compost is approximately 1% nitrogen and ¼% phosphorus and potassium, and contains many trace elements which are necessary for productive plant growth.

Soil which is constantly treated with chemical fertilizers will lose its productivity and can decrease crop yields in the long run. On the other hand compost can supply necessary bacteria and trace elements, and can restore physical properties of soils which will keep the soil at a high productivity level. The physical properties which are improved are water and nutrient holding capacity, support of earthworms, workability and porosity. Compost with nutrients added reduces the need for chemical fertilizers, promotes biologically active soil, and restores used soils to healthy ones. It has been proven, under test conditions, that "potatoes grown on composted land averaged 6% more nitrogen, phosphorous and potassium per pound than those grown on uncomposted but fertilized plots."* However, of recent concern in the use of compost is heavy metal content.

**Composting of Municipal Solid Wastes in the United States.*

TABLE 6.2
Composting Methods

Process Name	General Description
Bangalore (Indore)	Trench in ground, 2 to 3 feet deep. Material placed in alternate layers of refuse, night soil, earth, straw, etc. No grinding. Turned by hand as often as possible. Detention time of 120 to 180 days.
Caspari (briquetting)	Ground material is compressed into blocks and stacked for 30 to 40 days. Aeration by natural diffusion and air flow through stacks. Curing follows initial composting. Blocks are later ground.
Dano Biostabilizer	Rotating drum, slightly inclined from the horizontal, 9 feet to 12 feet in diameter, up to 150 feet long. One to 5 days digestion followed by windrowing. No grinding. Forced aeration into drum.
Earp-Thomas	Silo type with 8 decks stacked vertically. Ground refuse is moved downward from deck to deck by ploughs. Air passes upward through the silo. Uses a patented inoculum. Digestion (2 to 3 days) followed by windrowing.
Fairfield–Hardy	Circular tank. Vertical screws, mounted on two rotating radial arms, keep ground material agitated. Forced aeration through tank bottom and holes in screws. Detention time of 5 days.
Fermascreen	Hexagonal drum, three sides of which are screens. Refuse is ground. Batch loaded. Screens are sealed for initial composting. Aeration occurs when drum is rotated with screens open. Detention time of 4 days.
Frazer–Eweson	Ground refuse placed in vertical bin having 4 or 5 perforated decks and special arms to force composting material through perforations. Air is forced through bin. Detention time of 4 to 5 days.
Jersey (also known as the John Thompson System)	Structure with 6 floors, each equipped to dump ground refuse onto the next lower floor. Aeration effected by dropping from floor to floor. Detention time of 6 days.
Metrowaste	Open tank, 20 feet wide, 10 feet long, 200 feet to 400 feet long. Refuse ground. Equipped to give one or two turnings during digestion period (7 days). Air is forced through perforations in bottom of tank.
Naturizer or International	Five 9 feet wide steel conveyor belts arranged to pass material from belt to belt. Each belt is an insulated cell. Air passes upward through digester. Detention time of 5 days.
Riker	Four-story bins with clam-shell floors. Ground refuse is dropped from floor to floor. Forced air aeration. Detention time of 20 to 28 days.
T. A. Crane	Two cells consisting of three horizontal decks. Horizontal ribbon screws extending the length of each deck recirculate ground refuse from deck to deck. Air is introduced in bottom of cells. Composting followed by curing in a bin.
Tollemache	Similar to the Metrowaste digesters.
Triga	Towers or silos called "Hygienisators". In sets of 4 towers. Refuse is ground. Forced air aeration. Detention time of 4 days.

Source: Composting in the United States.

Studies are being conducted at universities in the country to determine the types and quantities of heavy metals in compost, their relationship to various soil and hydrogeologic conditions, possible uptake in agricultural crops, and potential effects on health.

Compost is not only used as an agricultural product but has uses in horticulture. These are small-scale markets which include gardens, lawns, golf courses and hothouses.

Agricultural markets for compost are difficult to establish on large scales because even though compost has many good qualities it is not as easy and inexpensive to use as many commercial chemical fertilizers. A new look at agricultural practices, research and educational efforts, incentives, and environmental factors may be needed to increase the use of compost.

Costs

At this time no details on costs can be given because of the wide variations in cost of existing operations. However, Figure 6.8 indicates potential partial recovery of operating and capital costs if compost and salvageables from the process are sold. It is obvious that unless unusual markets are available, composting is not a "get something for nothing" disposal system.

Composting in Wisconsin

As of April, 1973, the State of Wisconsin had one compost operation, located in Germantown. The plant produces a compost which utilizes raw manure from meat processing plants and stockyards. (This is not a municipal refuse composting plant.) The plant markets this product nationwide, and at present is very well established. These markets are small home and horticultural markets, not large agricultural ones.

In addition, four cities are composting municipal sewerage sludge and have markets for their product (Table 6.3).

Future of Composting in U.S.

Several factors will determine whether composting is or will be an important tool in Solid Waste Management in the future. Costs at present are not as favorable as those for landfilling and incineration. The USDA states however, "Composting is ecologically preferable to incinerators, landfills or ocean dumping."

Composting today is rarely used in the U.S. because of poor markets. However, composting may be a good solution to a part of the solid waste problem in the future. *Compost Science* states, "As more people in high places speak of putting the wastes back on the land, the time when composting becomes public policy gets closer and closer. Inch by inch waste management is being viewed as eventually winding up as an agricultural activity. As that happens, farmers and people living in the rural areas can benefit from the money that now goes mainly into dumping wastes somewhere."

It must be emphasized that composting is not a complete solid waste management system. Like incineration, it is a processing system that utilizes a portion of the solid waste in an area and converts it to another form. Large portions of waste cannot be taken to the composting plant and significant quantities of waste that are taken into the plant cannot be composted. Figure 6.9 shows an approximate breakdown of compostable and noncompostable material in solid waste. Composting, however, is expected to provide a viable solid waste management alternative in the future.

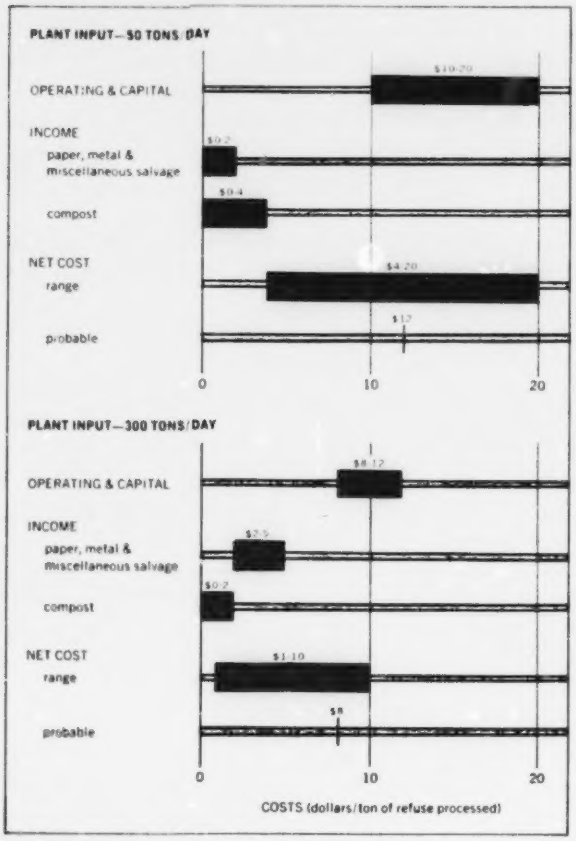


FIGURE 6.8 *Estimated Costs for Composting Municipal Solid Wastes in Favorable Locations*
From: The Problem of Solid Waste Disposal

FIGURE 6.9
Material Flow Pattern for Solid Waste, with Composting

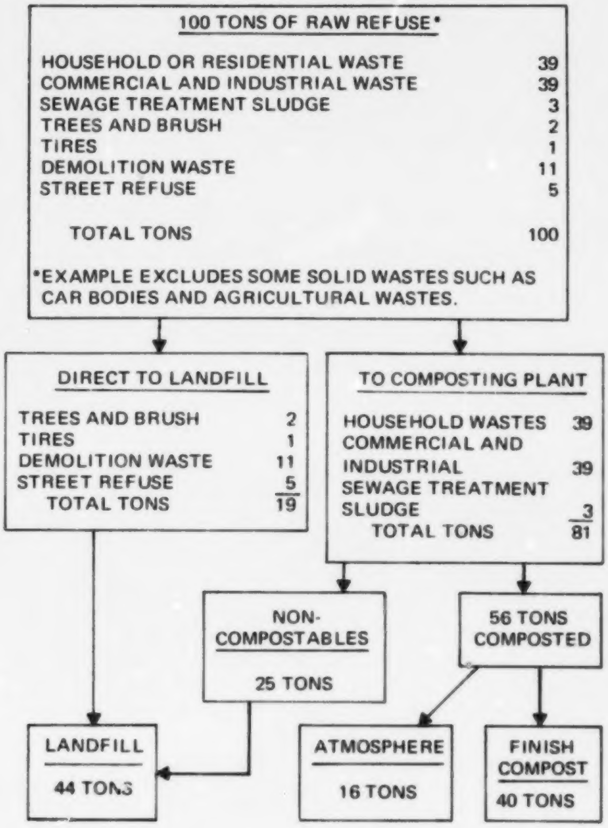

100 TONS OF RAW REFUSE*
HOUSEHOLD OR RESIDENTIAL WASTE 39
COMMERCIAL AND INDUSTRIAL WASTE 39
SEWAGE TREATMENT SLUDGE 3
TREES AND BRUSH 2
TIRES 1
DEMOLITION WASTE 11
STREET REFUSE 5
TOTAL TONS 100
*EXAMPLE EXCLUDES SOME SOLID WASTES SUCH AS CAR BODIES AND AGRICULTURAL WASTES.
DIRECT TO LANDFILL
TREES AND BRUSH 2
TIRES 1
DEMOLITION WASTE 11
STREET REFUSE 5
TOTAL TONS 19
TO COMPOSTING PLANT
HOUSEHOLD WASTES 39
COMMERCIAL AND INDUSTRIAL 39
SEWAGE TREATMENT SLUDGE 3
TOTAL TONS 81
NON-COMPOSTABLES
25 TONS
56 TONS COMPOSTED
LANDFILL
44 TONS
ATMOSPHERE
16 TONS
FINISH COMPOST
40 TONS

TABLE 6.3

Composting of Municipal Sewerage Sludge

City	Brand Name	Annual Output	Nitrogen	Phosphorus	Sales Trend	Price
Fond du Lac	Fond du Green	2,000 tons	2	2	Upward	$2.00 per 80 lbs. bag $18.75 per ton
Milwaukee	Milorganite	70,000 tons	5.5	4	Upward	–
Oshkosh	Oshkonite	600 tons	2.09	2.65	No change	Solid in bulk 2 bu.– $.25, cu. yd.–$2.00, Ground $3.00 cu. yd. No deliveries, sludge sold locally from plant
Sheboygan	–	1,000 tons	1.96	1.65	Upward	$.50 per 80 lbs. bagged, (retail local) Carload shipments price $5.75 per ton. (Sold to broker)

SIZE REDUCTION

General

Several wet and dry size reduction processes can be used to change the physical and sometimes the chemical characteristics of solid waste. The primary reduction mechanisms are compression, tension and shearing. Balers are an example of machines using compression. Hammermills use compression, tension and shearing in the process of milling refuse. The hammermill crushes the tin can and breaks the bottle (compression) and grinds the paper into small particles (tension and shear). Shears are widely used in the U.S. salvage industry and in some European incinerators to cut bulky pieces into smaller materials.

The following is a list of the more common size reduction equipment used for processing refuse in the salvage industry and in municipalities:

1. Crushers
2. Cage disintegrators
3. Shears
4. Shredders, cutters and chippers
5. Rasp mills
6. Drum pulverizers
7. Disk mills
8. Wet pulpers
9. Ball mills
10. Hammermills

The objectives of processing refuse are:

1. to reduce the particle size
2. to produce a more homogenous physical mass
3. to break materials down into a form that can be more easily separated into components for recovering
4. to produce combustible material with more surface area for more uniform and faster combustion
5. to reduce the volume required in landfills
6. to make the material compressible with less effort for landfill and baling
7. to facilitate material handling in the landfill or during resource recovery operations
8. to convert pulpable solid waste from a dry state to a wet pulp.

Figure 6.10 shows the three basic size reduction principles widely used for particle size reduction of solid waste. They are the horizontal shaft grinder, hammermill, and chipper. Another adaptation of these principles is the vertical shaft machines, where material is fed into the top and the particles come out the side of the machine or at the bottom. Figure 6.11 illustrates this principle.

Madison Project

In 1960 the City of Madison received an E.P.A. demonstration grant to investigate the European concept of milling refuse for landfill disposal. The main objectives of the project were:

1. to investigate the French manufactured Gondard hammermill and the British manufactured Tollemache mill, support equipment for operation, and the economics of each mill. (See Figure 6.12.)
2. to investigate milled refuse characteristics.
3. to investigate the use of milled refuse for landfill disposal without daily cover.

Early findings from Madison show the concept to have merit from the standpoint of landfill site volume savings and reducing daily operation problems. The economic studies indicate it is more costly than sanitary landfill, but the economics must be studied from a total solid waste management standpoint to fully evaluate the advantages and disadvantages.

The project has resulted in a cooperative effort with the Forest Products Laboratory, U.S.D.A., involving wood fiber recycling. Also, the City of Madison is presently involved in

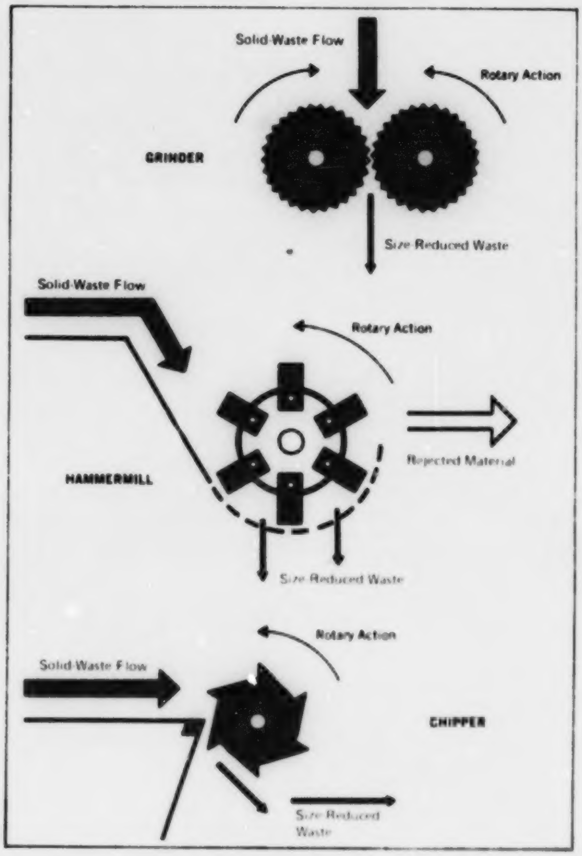
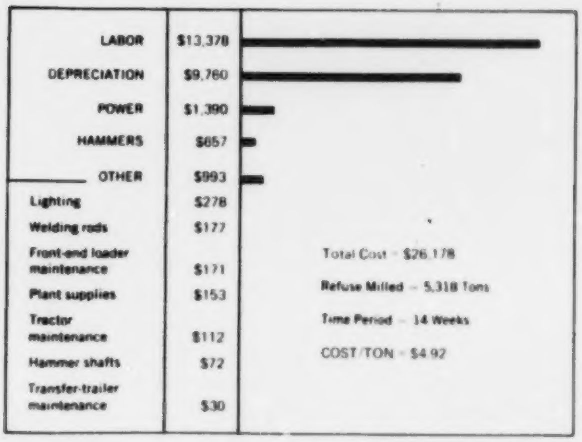

Solid Waste Flow
Rotary Action
GRINDER
Size Reduced Waste
Solid Waste Flow
Rotary Action
Rejected Material
HAMMERMILL
Size Reduced Waste
Rotary Action
Solid Waste Flow
CHIPPER
Size Reduced Waste

FIGURE 6.10 *Three Basic Methods of Achieving Size Reduction* *From: The Problem of Solid Waste Disposal*



Data from MILLING REFUSE FOR LANDFILL WITHOUT DAILY COVER (the Madison Report), Table 12

FIGURE 6.12 *Some Recent Costs of Milling Solid Waste* *From: The Problem of Solid Waste Disposal*

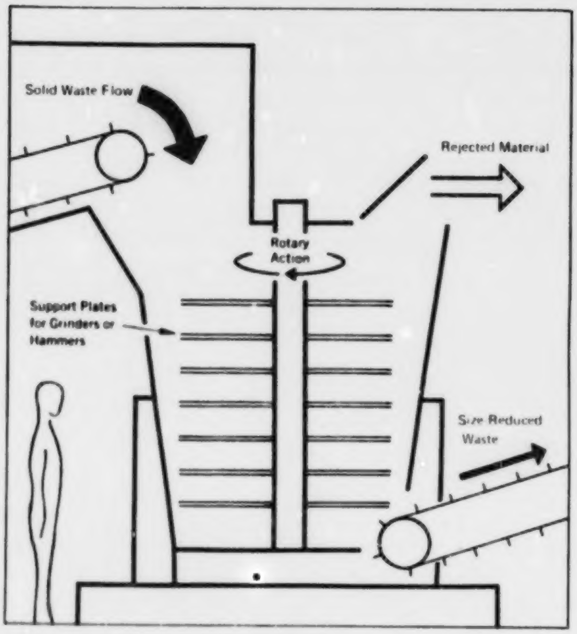

Solid Waste Flow
Rejected Material
Rotary Action
Support Plates for Grinders or Hammers
Size Reduced Waste

FIGURE 6.11 *Large-Scale Size-Reduction Units: A Schematic* *From: The Problem of Solid Waste Disposal*

a joint project with the Continental Can Company to magnetically separate and recycle ferrous metals from the milled refuse.

Other Projects

A milling facility is presently under construction by Outagamie County, and a number of municipalities in Wisconsin are considering milling.

The major direction of milling is toward the dry resource recovery systems. Approximately twenty milling facilities have been constructed in the United States to mill refuse for landfill disposal and/or for resource recovery.

Another adaptation of size reduction is in handling urban wood waste. A number of chippers, such as the Morbark and Vermeer chippers, have been developed to reduce logs and branches to wood chips. The chips are more readily handled and capable of being recycled.

Wet pulpers have been historically used in the paper industry to reduce dry salvaged cardboard and paper into a slurry which contains the wood pulp of the cardboard and paper in its individual wood fiber form. Wet drum pulpers are utilized in a number of places in Europe to change dry refuse into a wet pulp for land disposal. Several such installations have been constructed in the United States for recovery of resources and land disposal. The Black Clawson project at Hamilton, Ohio, is one of the more prominent ones intended for resource recovery. Figure 6.13 shows the basic concept of the wet pulper.

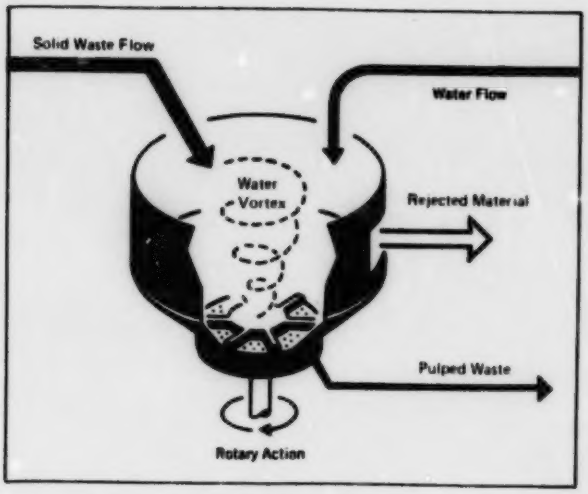

Solid Waste Flow
Water Flow
Water Vortex
Rejected Material
Pulped Waste
Rotary Action

FIGURE 6.13 *The Wet Pulper*
From: The Problem of Solid Waste Disposal

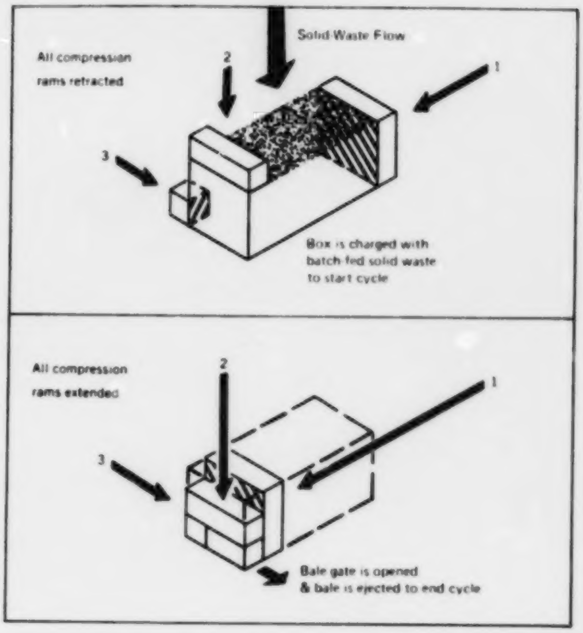

All compression rams retracted
Solid Waste Flow
1
2
3
Box is charged with batch fed solid waste to start cycle
All compression rams extended
1
2
3
Bale gate is opened & bale is ejected to end cycle

FIGURE 6.14 *A Three-Stroke Baling Process*
From: The Problem of Solid Waste Disposal

Baling has been approached from two technology standpoints:

1. High pressure batch baling;
2. Low pressure continuous extrusion baling of milled refuse.

Original work performed under the auspices of the City of San Diego indicated that shredding before baling allowed the use of a low pressure paper baler. Densities of approximately 1,500 pounds per cubic yard were experienced in early tests. Other tests with high pressure balers indicated banding was necessary for bale stability. Later experimental work performed by the A.P.W.A. under an E.P.A. grant to the City of Chicago indicated that a high pressure (2,500 psi applied pressure) three-stroke baler could produce a stable bale with a density of 1,800 pounds per cubic yard. At present a baling facility is being operated at St. Paul, Minnesota, by the Americn Solid Waste Systems Company, which is baling refuse in a three stroke high compression batch baler for landfill disposal. Baling municipal solid waste shows great promise in reducing the volume required for landfilling, and may also provide transportation cost advantages.

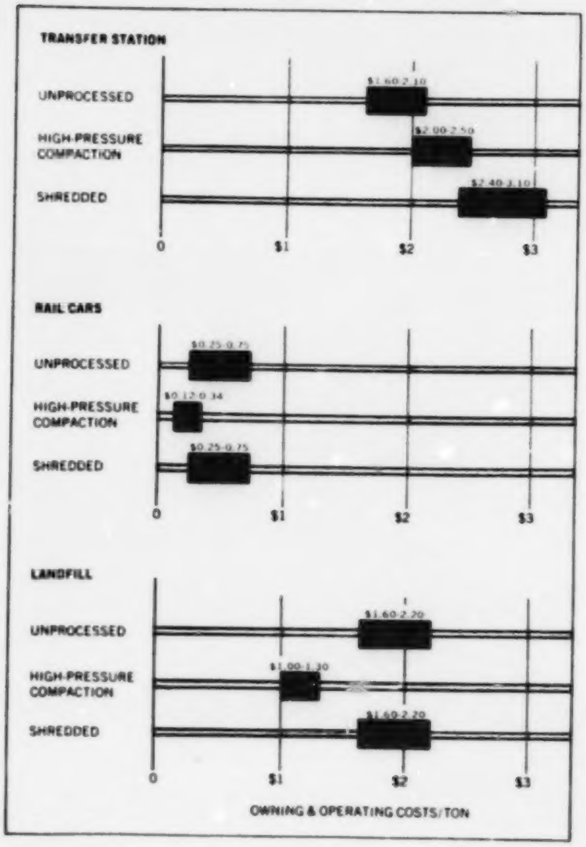
High pressure balers are also widely used in the salvage industry and are showing advantages in automobile hulk processing.

Figure 6.14 shows the basic compression action of a three-stroke baler. Figure 6.15 shows bales being handled in a landfill with a specially designed end loader. Figure 6.16 shows bales being rail hauled in a test performed on the stability of bales by American Solid Waste Systems.

Figure 6.17 shows the relative economics of processing, hauling and landfilling unprocessed, milled and baled refuse. To obtain a true picture of the economics of one or all of the systems, it is necessary to make an entire economic analysis of the solid waste management system for an area.

FIGURE 6.15 *Rail Haul Tests, American Solid Waste Systems, St. Paul, Minn. Dec. 2, 1972. Standard, large wheel forklift has taken two bales from flatbed car and is placing them in balefill.*

FIGURE 6.16 *American Solid Waste Systems, St. Paul, Minn. Nov. 22, 1972. Rock Island car put in train ahead of sloped bed bulkhead, pulpwood car.*



◁ **FIGURE 6.17**
Some Comparative Costs for Handling Unprocessed, Compacted, & Shredded Solid Waste
From: The Problem of Solid Waste Disposal

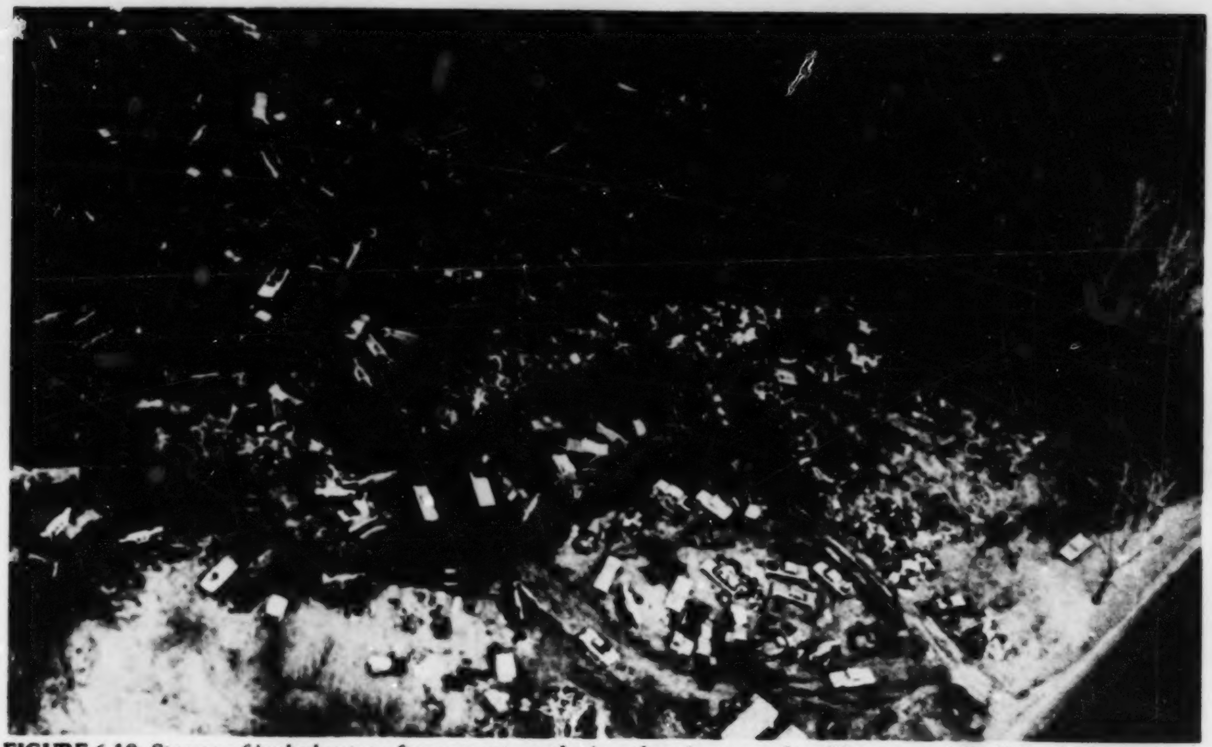


FIGURE 6.18 *Storage of junked autos often presents aesthetic and environmental problems, especially if the site is poorly chosen.*

AUTOMOBILE HULK PROCESSING

Introduction

Traditionally automobile hulks have been burned to remove combustible materials such as fabric and plastic. Attempts were made to remove the nonferrous metals such as copper. The remaining hulk was then shipped to steel mills for reuse at times when the price of scrap was high. The method was labor intensive, environmentally unacceptable, expensive, and inefficient. The result was that auto hulks did not readily move from salvage yards. Suitable economics did not exist for private industry to remove automobile hulks from remote areas, figure 6.18.

Mechanization of the procedure and development of processing equipment in recent years has resulted in a technology that can process and move unburned automobile hulks to steel mills in large numbers in an environmentally acceptable manner, and on the basis of suitable economics. Collection and processing of scattered automobile hulks from the remote countryside remains a major difficulty, however.

Equipment

Mechanized equipment has been developed, such as the end loader attachment in Figure 6.19 which is used to pick the engine block out of an automobile.

Automobile flatteners, such as shown in Figure 6.20, flatten automobile hulks into a compact size so that enough of the hulks can be loaded onto a truck (Figure 6.21) to transport them profitably over long distances. Figure 6.22 illustrates another type of flattener, and Figure 6.23 shows some of the stages of the flattening process.

Another development in the field of auto hulk salvage is the auto hulk grinder that has been developed in recent years to grind unburned auto hulks. The hulks are ground by large hammermills driven by 5,000 horsepower motors. These machines can handle an auto hulk every minute. The ferrous metal is then magnetically separated and conveyed to rail cars, ships or trucks for transportation to the consuming steel mills. The small pieces of metal provide a high density material for economical shipment. A recent development is the air classification of the copper, aluminum and brass from the fabric, plastic and other waste material. The concentrated nonferrous metal is shipped to processing facilities where the mixed nonferrous metal can be separated into its component parts for reuse.

Summary

The development of auto processing equipment has revolutionized the auto hulk business. Open burning of auto hulks is no longer necessary for salvage, and the capability to process large concentrations of auto hulks is improving. A problem that must receive special attention is the multitude of hulks that lie abandoned in fields, remote areas, and auto graveyards. These areas have, for the most part, been situated outside economical operating range of mobile hulk flatteners and other processing systems.

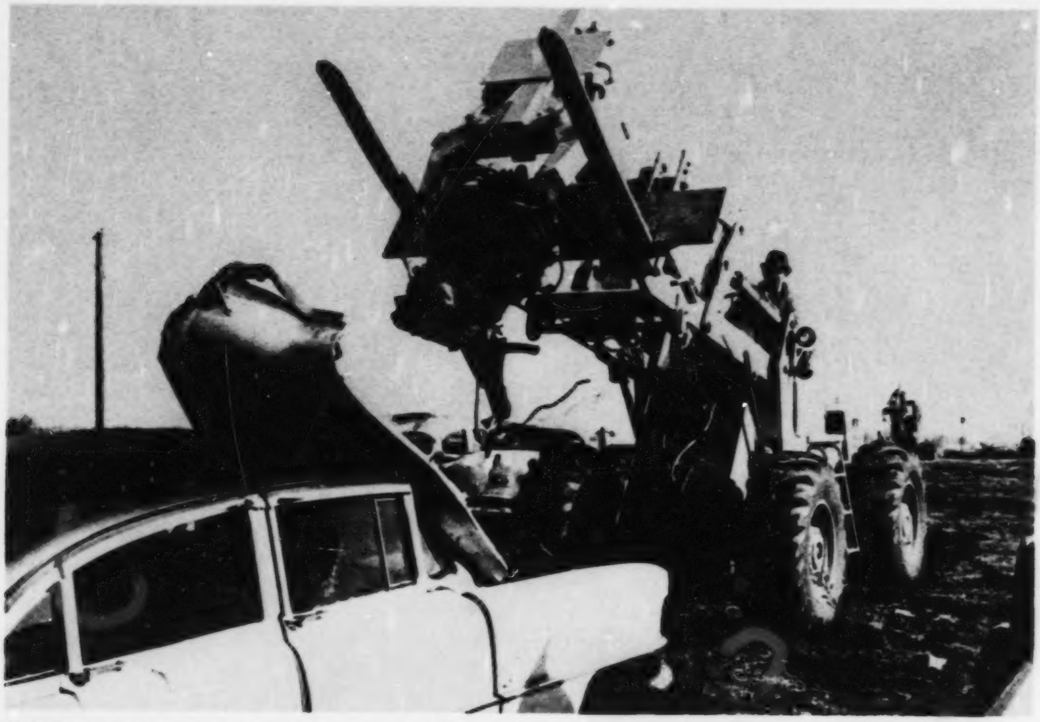


FIGURE 6.19 *Front-end loader equipped with apparatus to remove automobile engine blocks.*

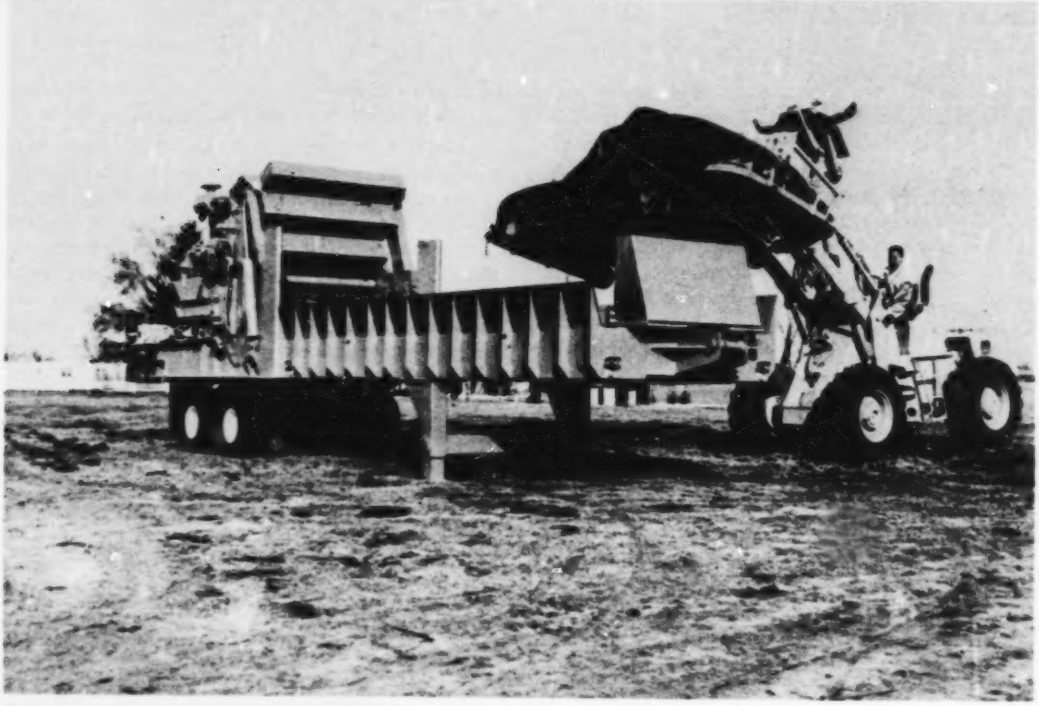


FIGURE 6.20 *A mobile car hulk flattener.*

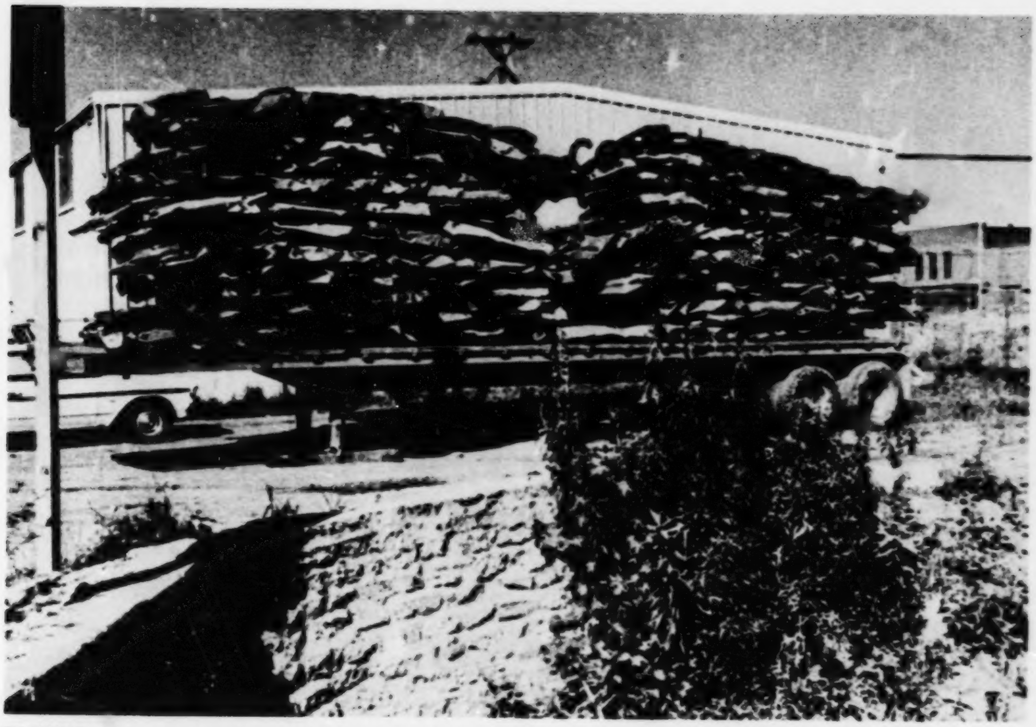


FIGURE 6.21 *Flattened car hulks loaded on a trailer for transport.*

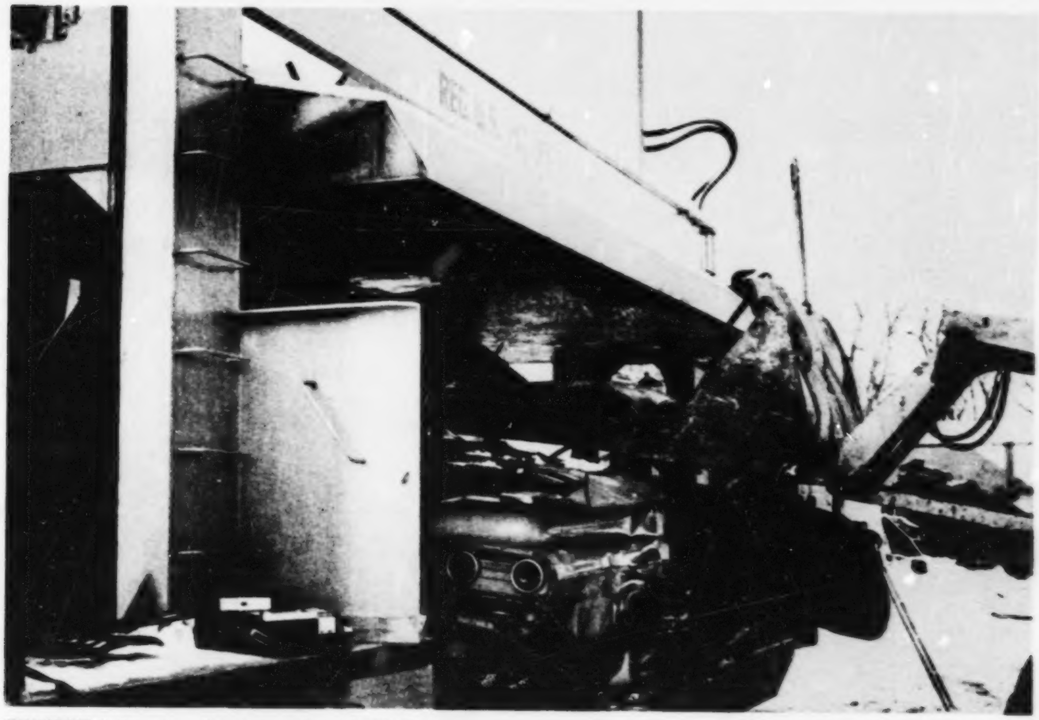


FIGURE 6.22 *Another type of car hulk flattener.*

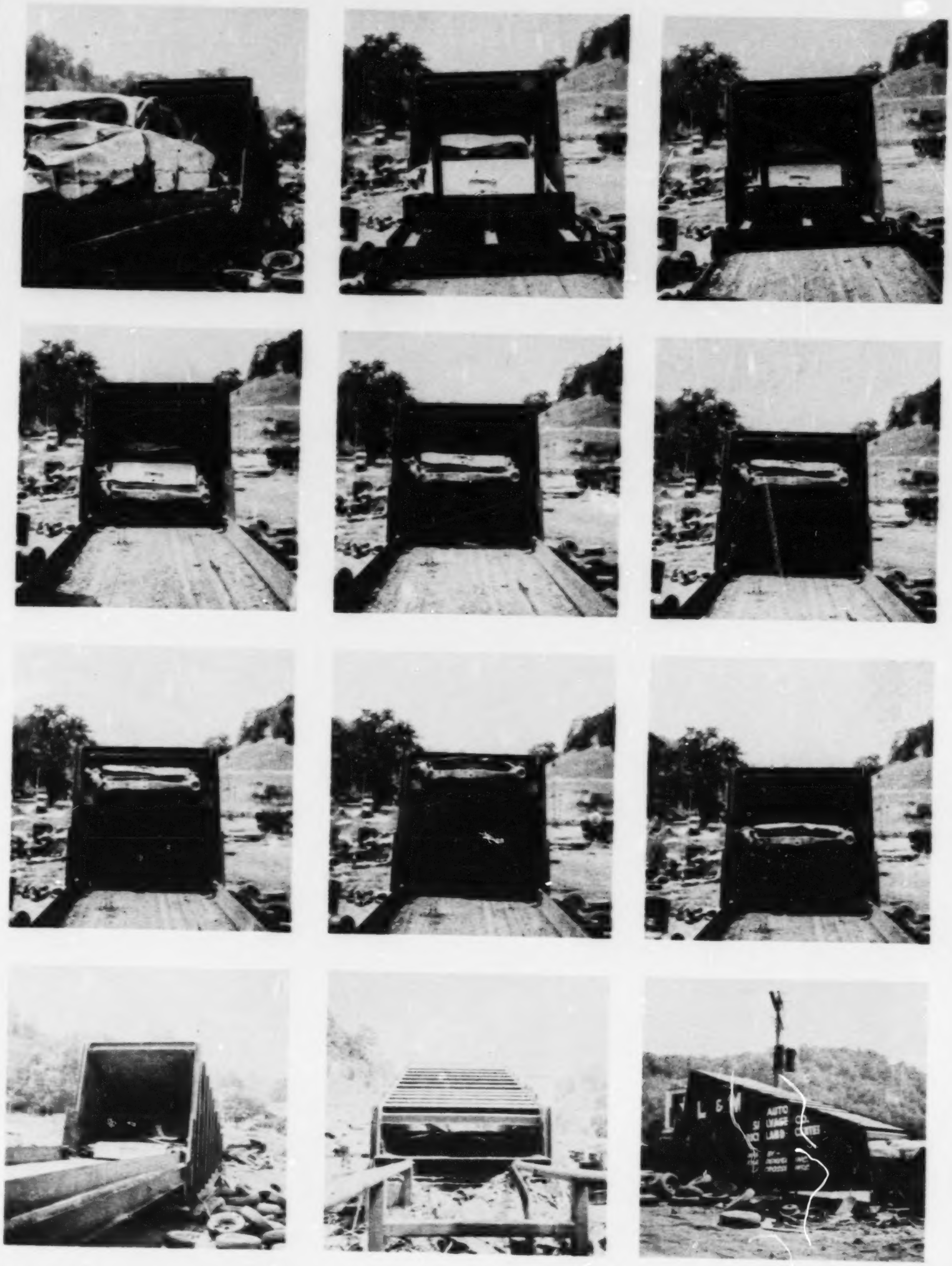


FIGURE 6.23 *Stages in the automobile hulk flattening process.*

●●●●● CHAPTER 7 • LAND DISPOSAL OF SOLID WASTES

Introduction

Preceding sections have dealt with waste generation, storage, collection, transportation, and processing methods. In every waste handling system, however, there must be provision for ultimate disposal, whether it be of the total waste load involved, or of the residue remaining after waste has been treated or partially salvaged. Under present circumstances it is not feasible to recycle everything; a waste fraction remains which must be disposed of. Due to concern over disposal into lakes or oceans, some form of land disposal is necessary.

Land disposal alternatives range from uncontrolled dumping, without consideration of ecological consequences, to carefully managed sanitary landfills, where waste is disposed of in a planned manner at a site engineered to have a minimum harmful effect on the surrounding environment. Proper disposal of wastes involves considerable effort, from planning, engineering and construction of a disposal site, to proper abandonment of a site when it has been filled to capacity. For this reason, it is often more economically and practically advantageous to have a relatively small number of large disposal sites, rather than many small sites, to allow the best chance for proper management. This has been shown by the Sauk County Plan and other county plans.

Prior to 1969, there were about 1,600 open dumps in Wisconsin, where waste was disposed of in a relatively unmanaged way. More than 500 of these were located in floodplains, wetlands, or in close proximity to surface water. The State of Wisconsin Solid Waste Disposal Standards were adopted in 1969 in response to a statutory obligation of the Department of Natural Resources to "prepare and adopt minimum standards for the location, design, construction, sanitation, operation, and maintenance of solid waste disposal sites and facilities..." (Wis. Statutes Chap. 144.43). The principle thrust of the standards was to encourage the proper establishment and use of sanitary landfills, and to discourage the use of open dumps, wherever possible. By early 1973, the number of open dumps in Wisconsin had decreased to about 990; these served only about 13% of the state's population, compared with 63% served by the 1,600 sites in 1969. Moreover, the number of sanitary landfills increased from only ten, which served 5% of the state's population in 1969, to about 280, which now serve 65% of the people. While many sites are presently better managed than previously, some old sites are presenting problems with leachate production and lack of cover material due to poor location.

Disposal Methods

The simplest method of waste disposal, and the most unacceptable, is indiscriminate dumping and littering; this creates environmental and aesthetic problems and is never presented as a viable disposal alternative. Many hazards and problems arise from the operation of open dumps. However, dumps can to some extent be hidden from public view, so they have been commonly used in the past.

The use of uncontrolled dumps has been favored in many communities for reasons of convenience, low cost, and lack of management necessary. Once an area is cleared for dumping, relatively little maintenance is necessary. But the problems associated with this type of operation make it an unacceptable alternative. For example, uncovered rubbish not only is unsightly and produces unpleasant odors but attracts insects, birds, and rodents. Rats are particularly common inhabitants of open dumps, and they can present a public health problem. The uncovered refuse also presents a danger to the safety of children. See Figures 7.1, 7.2, and 7.3.

Another major problem at open dumps is the burning of wastes. Occasionally, burning occurs accidentally, but it is usually done intentionally to reduce waste volume, thereby

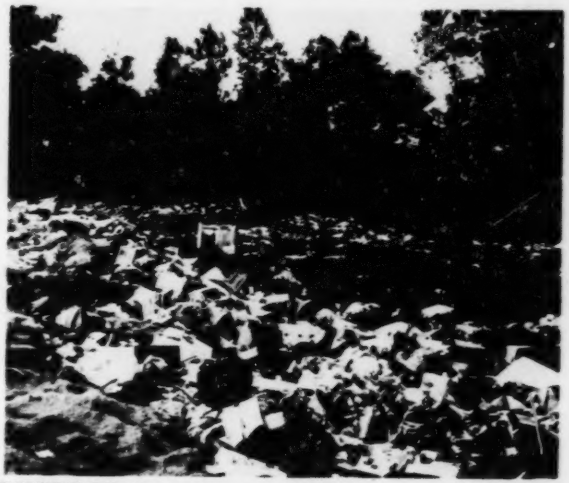


FIGURE 7.1 *Open dumping of solid waste creates a blight on the natural environment.*

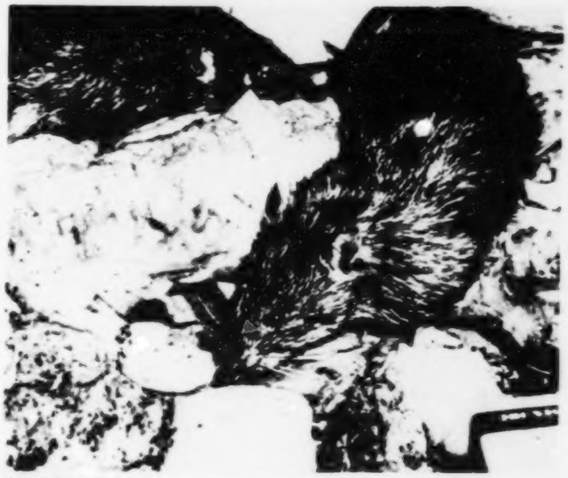


FIGURE 7.2 *Uncovered solid waste at disposal sites provides a source of food for rats and attracts flies.*

FIGURE 7.3 *Air pollution is one undesirable result of the open burning of solid waste.*

prolonging the life of a dump. Unfortunately, rubbish fires are grossly polluting; they emit large quantities of smoke and soot, thus raising ambient levels of particulates in the air. In addition, rubbish fires often become uncontrolled. In 1971, 273 incidents were reported in which dump fires spreading to adjacent property caused the loss of about 1,000 acres of forest land.

Because of the problems they create, unmanaged, uncontrolled open dumps are not licensed for operation by the Department of Natural Resources, under Chapter 144 of the Wisconsin Statutes. Instead, the development and use of sanitary landfills is encouraged. A sanitary landfill is a carefully planned, engineered, constructed, and managed site where waste is reduced to the smallest practical volume, confined to a limited space, and covered with a layer of earth and compacted after each day of dumping operations. In this way, odor, blowing paper, and rat and fly problems are minimized, fire hazards avoided, and rain runoff and infiltration controlled. Furthermore, when a landfill site is properly planned and operated, the possibility for environmental problems such as pollution of ground and surface waters by leachate are also minimized.

The establishment and operation of a sanitary landfill encompasses four basic steps:

1. site planning/selection
2. site design
3. site operation
4. site closure

A site should be selected with some knowledge of anticipated waste generation, which gives an idea of the amount of space needed. Once a satisfactory site is acquired, it must be properly designed for use. Past inadequate site designs have resulted in many operational problems. For this reason, revisions to the Wisconsin Solid Waste Management Rules (NR 151, Wis. Admin. Code), effective July 1, 1973, require the preparation of landfill site design plans by a professional engineer. While this will not cure all problems it will go a long way toward improving disposal sites.

There are several ways to operate a landfill. The method used is largely dependent upon the topography of the chosen site. Figure 7.4 gives a rough idea of four basic types of operation.

The slope/ramp and canyon/pit/quarry methods are suitable for sites with hills or depressions. On level ground, the area and trench methods are most appropriate. Use of the trench method is limited to areas where adequate soil thickness allows excavations to be made without encroaching too close to groundwater or certain types of underlying bedrock. Usually this means an unsaturated soil thickness of at least ten to fifteen feet should exist beneath the bottom of the lowest layer of deposited waste. However, factors such as groundwater movement, well use, and others will affect the soil thickness requirement.

The operation of a site is extremely important. A site which is properly designed and located but poorly operated may cause more problems and complaints than an improperly located site. In addition to routine compaction and covering of wastes, it is necessary that provisions be made for special problems, such as standing water and mud conditions which may result from heavy rains, frozen ground during winter months, and scattering of papers and other light wastes by wind.

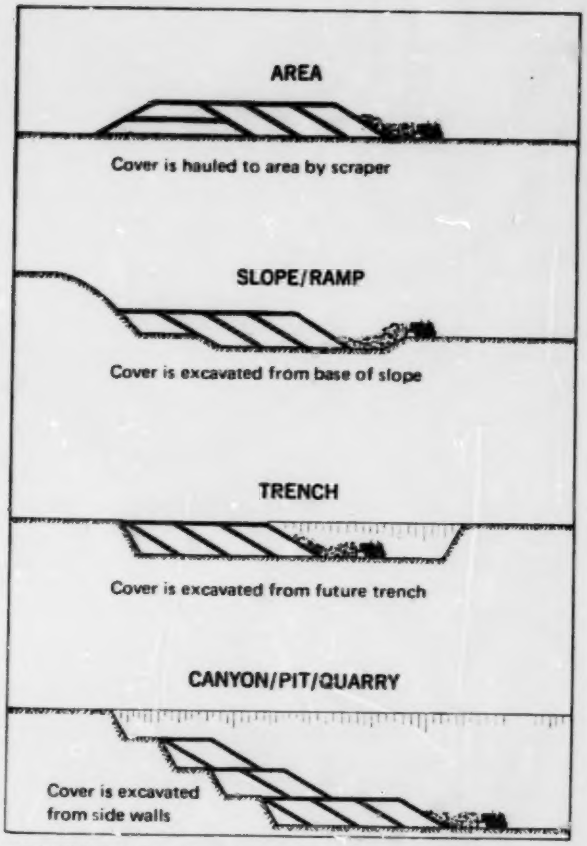

AREA
Cover is hauled to area by scraper
SLOPE/RAMP
Cover is excavated from base of slope
TRENCH
Cover is excavated from future trench
CANYON/PIT/QUARRY
Cover is excavated from side walls

FIGURE 7.4 *Basic methods of operating a landfill. From: The Problem of Solid Waste Disposal.*

When a site has reached the end of its useful life, it must be properly abandoned by covering it with a minimum of two feet of soil and finally seeding. Many times final site use will require other preparation of the land to make it satisfactory for its intended purpose. See Figure 7.5.

An extensive discussion of all the facets of sanitary landfill operation is not given here, but procedures required in Wisconsin are listed in Section NR 151.12 of the Wisconsin Administrative Code found in the Appendix.

The economic aspects of site operation are fully as important as the physical aspects discussed above. A site which overtaxes the financial resources of the population it serves usually is not operated properly. Land acquisition and preparation; equipment purchase, operation, maintenance; and personnel salaries are the major expenses of a landfill. If a site is designed to be used for a long enough time, land acquisition costs usually become a small fraction of the total cost. Personnel and equipment needs vary according to the amount of waste to be handled at a landfill; Table 7.1 gives an idea of the type of equipment which might be used at landfills of various sizes. Drawings of the types of equipment mentioned in Table 7.1 are shown in Figure 7.6.

Proper operation of a sanitary landfill involves considerable expense. Presently, when most small municipalities have their own waste disposal sites, the maintenance of a sanitary landfill can be exceedingly costly on a per person basis. Regional or multimunicipal waste disposal systems with centrally located disposal sites are therefore encouraged. This would allow the operation of high quality land disposal sites without undue financial strain on participating municipalities.

FIGURE 7.5 *A properly planned and operated landfill, when completed, can become an attractive community asset.*

TABLE 7.1
*Suggested Landfill Equipment Possibilities**

Solid Waste Handled (tons/8 hr.)	Crawler Loader		Crawler Dozer		Wheel Loaded		Approximate Capital Costs Equipped Machine June, 1970
	Flywheel Horsepower	Weight** (Lb.)	Flywheel Horsepower	Weight** (Lb.)	Flywheel Horsepower	Weight** (Lb.)	
0– 20	70	20,000	80	15,000	100	20,000	$21,000
20– 50	70 to 100	20,000 to 25,000	80 to 110	15,000 to 20,000	100 to 120	20,000 to 22,500	26,000
50–130	100 to 130	25,000 to 32,500	110 to 130	20,000 to 25,000	120 to 150	22,500 to 27,500	35,000
130–250	150 to 190	32,500 to 45,000	150 to 180	30,000 to 35,000	150 to 190	27,500 to 35,000	45,000
250–500	Combination of Machines		250 to 280	47,500 to 52,000	Combination of Machines		70,000
500–Plus	COMBINATION OF MACHINES						

*Compiled from assorted promotional material from equipment manufacturers and based on ability of one machines in stated class to spread, compact, and cover within 300 feet of working face.

**Basic weight without bucket, blade, or other accessories. For equipped weight, add 10–25%.

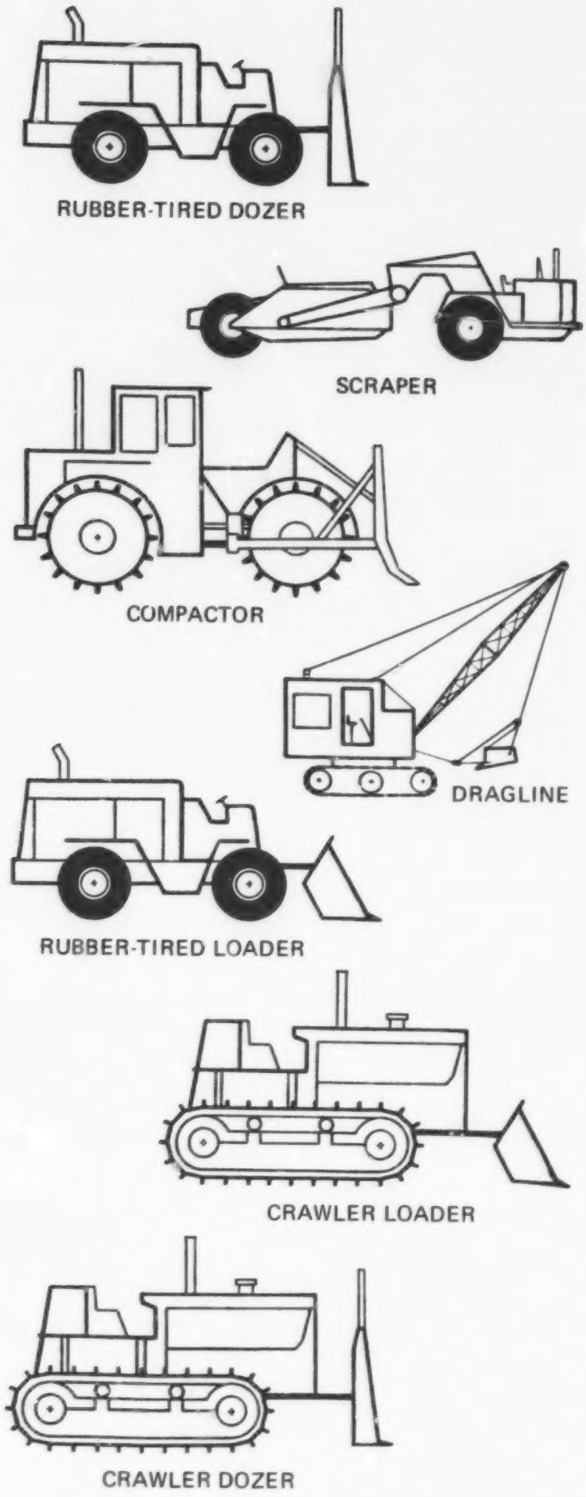


FIGURE 7.6 *Types of Equipment Used in a Landfill*
From: The Problem of Solid Waste Disposal

As an interim response to the difficulty of proper landfill operation by small municipalities, Administrative Code NR 151 (Wisconsin Solid Waste Management Rules) provides for modified procedures in certain cases. A site serving a population of less than 2,500 for example, may be issued a license exemption for operation without daily covering of deposited waste, providing site neighbors do not object. Exemptions from daily covering are considered by the Department of Natural Resources on a case by case basis. Some sites may also be operated with limited controlled open burning of clean, dry wood. Presently, exemptions from the general ban on open burning are issued for the burning of dry combustible rubbish at sites serving populations of less than 2,500. These exemptions will end on October 1, 1975.

The nature of the waste being disposed of may be such that it is not necessary to provide daily covering or frequent compaction. Wastes which consist primarily of concrete, bricks, stones, or other noncombustible materials, for example, may be compacted and covered as infrequently as twice per year according to the Wisconsin Administrative Code. However, whatever the type of waste, it is necessary to have a planned, controlled disposal operation.

For a number of land disposal methods currently under investigation, careful daily covering may not be necessary. Experience has shown, for example, that refuse which has been processed by milling may be satisfactorily placed in a disposal site without daily covering. Even without daily covering, milled refuse does not seem to produce excessive odors, and does not appear to attract rats or support combustion. The first large milling project in the U.S., fashioned after some European installations, was conducted in Madison, Wisconsin. Since 1968, this project has been studied intensely to supply much information used in guiding the establishment of federal policy on further milling projects. While milled refuse sites offer some advantages from the standpoint of covering frequency, much more planning and management is necessary than for even the highest standard of sanitary landfill.

Another disposal method currently in the experimental stage is landfilling of baled wastes. American Solid Waste Systems in St. Paul, Minnesota, is currently operating a high-compression baler which processes solid waste collected in Minneapolis and St. Paul. Baled waste is then deposited in a landfill south of St. Paul. Advantages of landfilling baled waste are the ease with which it is handled and the elimination of windblown paper problems. Perhaps the most significant advantage is the packing efficiency which can be attained, both in the bale itself and in the landfill site. While ordinary compacted waste in a landfill may have a density of 500-1,000 lbs. per cubic yard, baled waste from the St. Paul project has a density of about 1,800 lbs. per cubic yard.

Factors Involved in Location of Land Disposal Sites

Proper selection and planning of a disposal site must take place long before the first load of waste is delivered. This involves consideration of physical, economic, and social factors. For practical purposes, physical parameters and social restraints cannot be separated. The physical parameters evaluated in determining the suitability of a site will have effects on the economics, political relationships, and social interactions in the area. For example, proposed landfilling may bring about conflicting desires for land use. Sites which are suitable for sanitary landfilling may be equally good for other purposes such as farming, housing construction, highway location, and industrial development. The best alternative land use should be chosen on the basis of a combination of physical parameters, economic factors, and social benefits. Although landfilling of wastes is an important activity, it must be considered as only one of several possible alternatives for a tract of land.

In general, there are many suitable locations in Wisconsin for the establishment of land disposal sites. Thus, selection is likely to depend on political and economic decisions, more than those of a scientific or engineering character. But there are some areas of our state which have few potential sites. These areas require a detailed examination of existing physical conditions.

A number of physical factors are especially important in evaluating the potential of a site for landfill use. The main ones are soil characteristics, hydrogeology, and climate. Soil is not only important in the construction of liners, dikes, and seepage pits, which may be necessary at a landfill site; but is also used for covering deposited waste, and serves to attenuate leachate which may drain from waste deposits. The nature of the soil also affects the degree of percolation, and hence the drainage around a site. Deep soil over groundwater and bedrock also insure that with good design a site will have sufficient cover material.

In evaluating the suitability of soils of specific sites, the following characteristics should be considered:

TABLE 7.2
Physical Parameters of Landfills

Characteristics	Ideal Condition
Depth	Over 20 feet or greater to ground water and bedrock depending on soil type
Texture	Medium (Silt, silt loam, loam)
Permeability	Moderate (.63 to 3.0 inch/hr)
Drainage	Good to moderately good
Slope	Gently sloping to sloping
Location	Upland

Soil depth is of primary importance ("soil" is interpreted to mean all particulate material above bedrock). In addition to its importance in constructing a landfill site and covering deposited waste, deep soil in general affords better attenuation of leachates. The texture is important, in that it affects the workability of a soil. A very fine soil will often be hard to work, causing difficulties when covering waste. In addition, temporary roads built within landfill sites with very fine soil may become slippery and unmanageable during wet weather. On the other hand, if soil is too coarse, it may not serve satisfactorily, either. Leachate drainage may be of such speed that desirable attenuation would not occur.

Drainage and permeability of soil are closely related. A soil which drains well is unlikely to accumulate standing water, as an impermeable soil might do. It is undesirable to have standing water in a landfill area, since this increases leachate formation and the potential for water pollution problems. The location of a landfill and the surrounding land slope are significant for similar reasons–an upland location and a gentle slope aid in water drainage.

In most areas of the state, soils suitable for landfill operations can be found without much difficulty. In some areas, however, careful study is necessary. For instance, in central and northern Wisconsin large areas are found where soil is very coarse and permeable, and thus unsuitable. Soils in the southwestern part of the state are shallow, and frequently fractured carbonate bedrock is at or near the surface. Steep slopes in this area create operational difficulties for landfills. Though having less problems with steep slopes, the Door Peninsula also has shallow soil deposits, and fractured bedrock. Table 7.2 indicates most desirable or ideal conditions for various landfill soil characteristics.

Geologic considerations in the selection of disposal sites have been almost ignored until recently. Presently the analysis of geologic parameters, such as the depth to bedrock, the character of surficial and bedrock layers, and geomorphology is of prime importance in locating a site.

If the geologic parameters indicate that bedrock is a shale formation or solid crystalline rock, landfill operations might be permissible. If bedrock is highly porous or fractured, the use of the site is very much restricted.

Although geologic parameters of site location are important, selection of a land disposal site depends mainly upon hydrogeologic suitability. Only recently has the problem of site location been approached from a hydrogeologic standpoint. The exact relationship of local groundwater flow systems and solid waste disposal operations is still uncertain and is being extensively studied in the United States. Groundwater pollution may result from leachate produced in the decomposition and stabilization of wastes in a landfill. Continuous or intermittent contact of refuse and water generates leachate, a liquid characterized by high concentrations of dissolved chemicals, chemical and biochemical oxygen demand, and hardness. The composition and concentration of leachate is extremely variable since it is a function of the composition of refuse and the carrying ability of water. Infiltration, surface runoff, or a high water table will saturate the refuse and produce leachates which subsequently will mix with the groundwater. Fractured bedrock, or soils with a high permeability have limited usability for land disposal operations because of the rate at which they can transmit leachates. Leaching is most active in areas where the landfill intersects the groundwater table. If a sanitary landfill is located so that no portion of it intercepts groundwater, leaching has been found to be limited. In areas of shallow water table, where refuse is in continuous contact with water, leaching is a continuous, polluting process. Recent experiments show that gross pollution within and immediately adjacent to a landfill site is significantly reduced within several hundred feet by such processes as dilution, dispersion, ion exchange, sorption and filtration. The movement of leachates is a function of soil infiltration and percolation rates, hydraulic head and soil permeability.

Another factor that is being experienced in Wisconsin, with sites located in areas of high groundwater (wetlands, floodplains and on river banks) is inadequacy of sufficient cover material to run a sanitary landfill properly. The high groundwater results in wet soils and standing water, which prevents the proper operation of equipment. Not only are these sites experiencing leachate problems, but they are also running out of cover dirt and are experiencing other operational problems. Proper hydrogeologic settings not only minimize potential leachate but also greatly enhance other aspects of sanitary landfill operation.

Consideration of runoff and surface water are also important in land disposal site selection. Avoidance of floodplains and provisions for safe distances to navigable waters or sources of water supply substantially limit the available land which can be used for waste disposal. Almost all landfills in Wisconsin require modifications to control surface water runoff in and around the sites. Sites should be located so that any leachate is attenuated before entering surface water systems. In cases where discharge of leachate into surface waters occurs, it can be collected and treated and purified in a manner similar to the treatment of effluents from sewage treatment plants.

Consideration of climate is also important in establishing a landfill site. The effects of climate are quite different than those of the physical parameters discussed above. If soil characteristics are unsatisfactory at a particular site, a different site may be found. However, the operation of a disposal site must be adapted to existing climatic conditions, no matter what they may be.

Because of the state's position in a temperate zone, precipitation exceeds evapotranspiration, and moisture is usually available in quantities adequate for saturation of landfill sites and subsequent production of leachates. The rate of formation of leachate is controlled, in part, by the amount of precipitation, so precipitation generally imposes greater problems in the spring when it is at a maximum.

Rainfall can cause severe erosion, gullying and runoff conditions, all of which adversely affect disposal operations. Rain can also cause operational problems by creating muddy areas in which equipment cannot function, and where cover material is impossible to spread.

Winter weather conditions also cause problems in landfill operation. Frost is the major problem, causing soil freezing which makes waste covering difficult and causes runoff problems when spring melting occurs. In Wisconsin soil freezing begins in the latter part of November and lasts until the middle of April. Maximum frost penetration occurs in the middle of March, when average frost depths range from approximately 30 inches in the central part of the state to 12 inches or less in the extreme north and south. Depths are less in the north because of greater snow cover, and in the south because of milder temperatures.

Disposal sites located in windy areas will need to have litter fences around the operating area and personnel to clean up the blown papers at the end of each working day. Such sites can be very dusty and irritate people living or working nearby. Trees planted on the perimeter of a site will help contain dust and litter. Water sprinkling or the use of other dust palliatives is often necessary along access roads.

Land disposal is a necessary component of any waste management system. Even if solid waste is processed or partially salvaged, there will always be some material which must be disposed of. Currently, the most acceptable method for land disposal of wastes is sanitary landfilling, wherein waste is compacted to a minimal volume and covered frequently with earth, thus avoiding problems with rats and flies, and preventing air pollution which would result from open burning. Though sanitary landfilling is the most satisfactory way of disposing of solid waste on land, exceptions to the practice are currently allowed in Wisconsin to avoid unnecessary expense in the case of clean, noncombustible wastes, and to avoid financial hardships in the case of sites serving small populations. In addition, new disposal methods currently under investigation, such as filling of milled or baled waste, may result in satisfactory alternatives to standard sanitary landfill procedures. Also, industrial wastes such as paper mill sludge, foundry sand, fly and bottom ash and wood wastes may warrant modification of the daily cover principle.

A sanitary landfill is a facility which must be properly planned, operated, and closed when it has completed its intended service. The planning of a landfill is especially important, and includes careful consideration of a variety of physical factors such as soils, hydrogeology, and climate, as well as social factors. A site which is well adapted for use as a landfill is apt to suit other needs as well. Thus, selection of a landfill site will likely involve difficult politcal and economic decisions, as well as consideration of physical parameters.

INTRODUCTION

Recycling, or resource recovery, is currently receiving a great amount of public attention and public controversy. The public attitude varies from one of–"resource recovery must be implemented at once regardless of economic cost, because nonrenewable resources are being lost forever at an intolerably rapid rate", to one of–"resource recovery should only take place when present economics warrant, because new materials will be developed or found to replace sources presently beleived to be nonrenewable". The truth lies somewhere between these two opposing views.

Consideration of resource recovery requires balancing the concepts of reusing natural resources against such complicated problems as energy balances, political and technical availability of raw materials, and possibilities of gathering large quantities of waste materials within existing institutional arrangements. Also consideration must be given to nature's process of renewing lost resources. Pulpwood to produce paper can be grown in less than twenty years; redwood to make siding takes thousands of years. Such a fact must be considered when making policy decisions.

To fully understand that resource recovery or recycling is not an end in itself but only part of the cycle of natural resource use, it is necessary to examine the flow of raw material through product manufacture to disposal and natural renewal.

Figure 8.1 shows this cycle of resource use and disposal. A major problem shown with this type of resource use cycle is that raw material, at one time found in fairly pure, concentrated locations, has been used in production of goods and then mixed with goods made of other materials and finally dispersed in low concentrations into many disposal sites throughout the earth. Once placed in disposal sites, these materials are technically and economically very difficult to retrieve.

Figure 8.2 indicates the part recycling or resource recovery plays in the resource use-disposal cycle. The degree of resource recovery will affect the amounts of raw material that will be used in the production of goods.

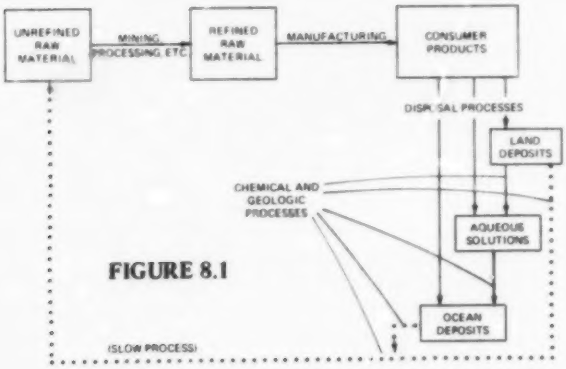


FIGURE 8.1

WITHOUT RESOURCE RECOVERY EFFORTS, NATURAL RECYCLING OCCURS VIA SLOW PROCESSES

Three basic concepts may be included in a discussion of recycling. The first is reuse, as in the case of returnable beverage bottles. A product may be designed so that it can be used a number of times with minimal effort and resources required for maintenance. Fundamentally, the emphasis in this case is to prevent the production of waste. Two other recycling concepts involve ways of dealing with waste produced, without necessarily working to stop waste generation. Recycling, as the word is currently used, generally refers to activities through which materials are recovered from waste, to be processed and subsequently used as raw materials for other manufacturing purposes. An example of this type of recycling is the reclamation of newsprint paper fibers which may eventually be used to produce more newsprint or to produce other paper products. The third major type of recycling is energy recovery. This involves treatment of wastes in such a way as to extract energy or substances from which energy may be readily extracted. Examples of this are combustion of refuse to supplement fossil fuels, recovery of steam from water-wall incinerators used for burning various combustible wastes, and harvesting of methane gas from the anaerobic decomposition of organic waste materials.

While many factors are important in discussing the potential of recycling activities, three are particularly critical: technological capabilities, available markets, and institutional arrangements.

TECHNOLOGICAL CAPABILITIES

Present technological capabilities are extensive. A 1973 publication prepared for the Council on Environmental Quality by the Midwest Research Institute entitled "Resource Recovery–The State of Technology", summarizes available techniques and gives cost and operational information. It is the premise of this report that separation of mixed wastes is essential to a successful recovery program. To be economically reasonable separation must be mechanical rather than manual. In order to make mechanical separation possible waste size reduction is necessary in most cases to provide uniformity of size and produce material that can easily pass through sorting equipment.

Size reduction is conceptually rather simple. For most applications a single heavy-duty machine is all that is

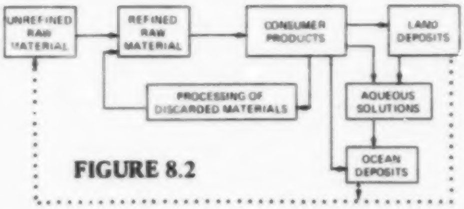


FIGURE 8.2

RESOURCE RECOVERY EFFORTS PROVIDE A RAPID PATHWAY FOR THE CONVERSION OF DISCARDED PRODUCTS TO REFINED RAW MATERIALS required. Depending on scale of operation and size of processed material, costs are generally in the range of $2-4/ton for size reduction. Some of the techniques for separation, on the other hand, are very sophisticated and complex. It is this phase of refuse recovery which will involve the most expense and effort. Such principles as air classification, cryogenic processing, magnetic separation, and optical sorting give an idea of the range of possible separation processes. Technical developments are occurring at such a rate that it can almost be said it is possible to separate any material from a waste processing stream. Costs of separating are difficult to estimate for they vary widely with degree and type of separation involved, scale of operation, etc.

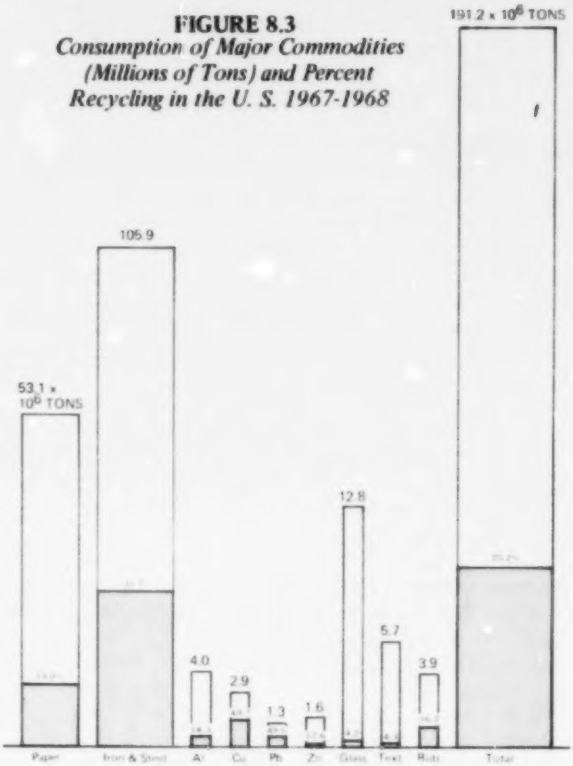
One type of separation which has been promoted in the past is separation of refuse by the homeowner before collection. Such a system, if functioning, has the benefit of not requiring elaborate separation machinery; however, there are a number of limitations. The process is subject to human error and noncooperation. The added cost of collecting segregated waste may outweigh the benefits of the separation. Also the processing necessary to treat the partially segregated waste may not be reduced by enough to justify the initial separation. In-house separation is probably best suited to programs where only a partial, rough separation is made, for example, the separation of newspaper and aluminum cans from domestic refuse.

MARKETS

One of the most critical factors in resource recovery programs is the establishment of markets. Present technology may be capable of almost any type of separation, but only market demand can allow separation methods to be made economically feasible. In Wisconsin there have traditionally been good markets for salvaged materials. Currently there are industrial markets for paper and glass of all kinds, auto hulks, nonautomotive steel, certain nonferrous metal products, and various wood by-products such as bark, sawdust, and wood chips.

In general salvage markets fluctuate widely over time. Most virgin raw materials are available in such supply and/or state of purity that they are more attractive than secondary materials to manufacturers. In addition, various economic factors currently discriminate against the handling and transportation of secondary materials. Figure 8.3 shows the quantities of major commodities consumed annually in the U.S. as of 1968-69, and indicates what fraction of this consumption was the result of recycling. Paper recycling has been slowly decreasing since the Second World War. Presently about 19% of paper fibers are recycled. A 1972 report by the Midwest Research Insitute suggests that with no external forces acting upon the industry, about 17% of paper fibers will be recycled in 1985. However, the same report anticipates that pressures will bear on the industry which will bring the recycling percentage up to 26% by 1985.

FIGURE 8.3
Consumption of Major Commodities (Millions of Tons) and Percent Recycling in the U. S. 1967-1968



Ferrous Metal. One source of ferrous metal is junked automobiles and appliances. There already are several installations within the State which recover metal from this source. Magnetic separation of ferrous cans from solid waste is also practiced. Cleaning, and possibly densification, may be necessary before marketing; the degree of processing required depends upon the specific market.

Three markets are potentially available for cans from the Wisconsin area. The first, and probably the most promising, is as a raw material for detinning operations. The detinners remove the tin from the cans by a chemical process, thereby reclaiming the tin, as well as enhancing the value of the cans to the steel industry and to the copper mining industry. The second market for ferrous cans is the copper mining industry in Arizona and Montana, where the prepared cans are used for refining copper from low-grade ore. This market probably would require the cans to be flame-cleaned before shipment. The third outlet for ferrous metal is the steel industry. Flame-cleaning and baling (to achieve greater bulk density) is often required for this use. A nuggetizing process now is being installed in a City of St. Louis installation which is intended to permit the ferrous material recovered from municipal solid waste to be utilized directly in blast furnaces. Indications are that this latter process may permit wider latitude in the reuse of salvaged ferrous materials for the direct production of steel.

Another outlet for recovered ferrous metal is the so-called "mini-mills" in which ferrous metal, principally from derelict automobiles, together with a relatively small quantity of raw solid waste, could be utilized for steelmaking.

Nonferrous Metal. Although the quantity of nonferrous metal in solid waste is small, its value is high, and because there is a definite market for the material, it can play an important part in any recycling program.

The outlets for nonferrous metal are the secondary smelting companies, who are interested in purchasing the metal either as a clean mixture, or as individual components, such as aluminum, copper or zinc. The largest single component of the mixture is aluminum. At present it appears to be doubtful that there would normally be economic justification for separating the components at a recycling center. However, in some cases even hand separation of copper, lead and zinc from the aluminum has been found to be economical. The mixture of nonferrous metal, if reasonably clean, has a stated value of $240 to $280 per ton.

Glass. Existing techniques for recovering glass from solid waste on a large scale are limited, and the quality of the glass which may be recovered by practical means in solid waste recycling plants is also limited. The most attractive markets for reclaimed glass now require color separation. Techniques for color-sorting of glass on a large scale are not yet perfected. It is possible that glass manufacturers, in an effort to maintain or regain their position in the container field, will adjust their processes and products to utilize mixed glass cullet. Until this is done, only a relatively small quantity of glass can be counted upon to be sold back to glass manufacturers.

At present, the best potential outlet for mixed glass is as a substitute for a portion of the aggregate used in asphaltic concrete. Such a substitution normally would require at least permissive specifications on the part of county highway and municipal street departments. If the specifications were to require a portion of the aggregate to be reclaimed glass, this type of outlet would become assured. The value of the glass used for this purpose should be in the range of $2 to $3 per ton.

Another potential use for mixed glass is in the manufacture of glass wool for insulation. This market could be encouraged by modifying construction specifications to give preference to its use.

Organic Fraction. One of the most promising markets for the organic fraction of solid waste is for use as a supplementary fuel in power plants. The only application of this process up to this time is in a full-scale prototype installation, operated as a joint venture between the City of St. Louis and the Union Electric Company. It is currently undergoing extensive evaluation and testing. Indications are that the process has substantial promise of success.

Several of the electric utilities within the State have facilities which are potentially adaptable for using solid waste as supplementary fuel. In some locations there may be more burning capability than is required for the quantity of solid waste available as fuel.

The application of this process is not limited to utility boilers. Certain types of boilers in common use in industries and institutions also may be readily adaptable for using solid waste as fuel. Although such boilers normally will not have the capability of consuming the great quantities of solid waste that utility boilers can utilize, they may provide a significant outlet for waste generated in smaller communities. The value of the processed solid waste as fuel depends upon the cost of the normal fossil fuel to the utility and upon the capital and operating costs to the utility in burning the waste.

Another potential for use of the organic fraction of solid waste is humus production. About 30 percent of raw solid waste could be converted to humus by means of a composting process. Although there have been numerous attempts to produce and market humus from solid waste in the United States, none of them have been successful other than on a modest scale, principally because of marketing difficulties.

The markets which are believed to have some potential include uses such as:

Lightweight Fertilizer Carrier
Synthetic Potting Soils
Mulch and Soil Conditioners
Mushroom Compost
Top Dressings and Organic Fertilizers
Animal Bedding and Litter

Although these potential markets are limited, the price for humus is estimated to be an average of about $17 per ton. The production of humus could also be made more attractive economically by including sewage sludge in the composting process. This has been done successfully in many European installations, but has yet to be proven in this country.

A third use for the organic fraction of waste is already made in some installations in this country: the production of steam. The market for steam in Wisconsin does not seem to be such as to warrant serious consideration of this use at the present time.

Dry Mixed Wastepaper. About 28 percent of normal solid waste can be recovered as dry mixed wastepaper. Although the dry paper available from a recycling plant is of mixed quality, it is clean and almost free of plastics. It is not, however, of high enough quality for other than limited use.

There are two potential markets for this material, namely the paper stock market and the fiberboard market. Dry mixed wastepaper can be used in the manufacture of paperboard, boxboard, roofing felt, insulation and binderboard, all through the paper stock market. The value of this material is estimated to be in the range of $5 to $7 per ton. When dry mixed paper is combined with approximately an equal weight of wood chips, the product becomes a desirable feedstock for the dry fiberboard industry. Although there are several Wisconsin manufacturers who use fiberboard in their products, the board presently is shipped to this state from remote locations. There appears to be a significant potential market for the dry mixed paper and wood chips for this purpose.

The value of the dry mixed wastepaper for fiberboard manufacture is estimated to be about $8 per ton; wood chips for this purpose would have a value of approximately $13 per dry ton.

Present Limitations on Markets

As stated previously the extent to which recycling does and will occur is critically dependent upon preexisting markets, i.e., upon demands. It is commonly said that salvaged materials are bought, not sold. The dealer in salvaged material is dependent upon those who buy his wares. His product is generally not so valuable that he can exert market pressures by withholding it, changing the price, etc. There is a way to change this pattern, however. In recognizing the environmental and economic benefits which can occur through recycling every consumer can help to create a demand for recycled products by requesting them and expressing interest in them each time he makes a purchase. In part, this may also mean expressing willingness to accept products of slightly different characteristics than those to which he is accustomed. For example, processing of glass for recycling is quite expensive, partially because of the difficulty of separating glass by colors. If there were a market for products made from salvaged glass of mixed colors, then glass processing could be made more economical.

Historically, the salvage industry has recycled large amounts of resources that would otherwise become solid waste at a landfill. The amount of resources recycled by the salvage industry has depended on the demand from other industry for the recovered material and the availability of space in the salvage yards to build inventories for future market demands. The salvage industry has historically taken care of high value resources when there was an economic incentive to recover them. For the most part the existing industry deals with resources that are not mixed or are easily separated. For example, paper must be of a specified grade, not mixed, as found in refuse. The car hulk can be ground and the ferrous metal magnetically separated and the nonferrous metal air classified. However, as response to environmental stresses increases, and as certain resources become more scarce, mixed refuse and uncleaned wastes are taking on values which many times justify the added expense of separation and cleaning processes.

INSTITUTIONAL ARRANGEMENTS

Governor Lucey appointed a Task Force in July, 1971, in an attempt to bring technology and markets together in the real world of institutional arrangements to accomplish recycling. The following Executive Order was issued:

WHEREAS, the United States is facing an ever-increasing demand upon the supply of its natural resources;

WHEREAS, the present methods of solid waste disposal incineration and landfill, deplete our supply of natural resources and degrade the quality of our air, land, and water;

WHEREAS, recycling is the best long-range solution to Wisconsin solid waste and other environmental problems;

WHEREAS, Wisconsin provides an ideal market for recycling with its variety of industry and a large supply of waste materials;

WHEREAS, industry, government, and the scientific community must make a unified effort to develop recycling in Wisconsin;

NOW, THEREFORE, I, Patrick J. Lucey, Governor of the State of Wisconsin do hereby create the Recycling Task Force and charge the Task Force to develop a plan for a center to recover, reclaim, and recycle all types of solid waste.

This Executive Order acknowledged the problems caused by solid waste generation and accumulation under current management practices, and ordered a planning process to begin on the establishment of a recycling center in Wisconsin. Since its establishment, the Governor's Task Force published a report in February, 1972, and recommended the creation of a board of consulting engineers to determine what methods of recycling could best be adapted to Wisconsin's needs.

In June, 1972, a Board of Engineering Consultants was commissioned by the State of Wisconsin to prepare a report as recommended by the Task Force. In June, 1973, the Board of Engineering Consultants released its report. A summary of findings is included in the appendix of this report.

Additional Factors Important to Recycling in Wisconsin

Factors that have become important in Wisconsin in regard to set-up of major recycling programs are:

1. That a recycling program is part of a solid waste management system and depends directly on good waste management support services such as collection, transportation, transfer, and disposal.
2. That in a recycling program, as in a program involving primarily disposal, local solid waste management needs must initially be met by sound waste collection services.
3. That a regional approach to recycling programs is critical in order to provide sufficient quantities of waste to operate complex mechanical systems and to assure predictable and substantial supplies of recovered materials for various markets.
4. That local intergovernmental cooperation and planning often at the county level, can lead to solid waste management systems which can meet local needs and which can readily fit into regional recycling programs.

At the time of this writing the recycling program is receiving legislative consideration. Development of a state recycling program will directly affect solid waste management planning at the state and local levels. Should the proposed legislation become law, close coordination and cooperation will be needed among all agencies involved in solid waste management programs.

(See Chapter 3 for additional details.)

SOURCE REDUCTION

Source reduction is defined as the decrease in the generation of waste by decreasing the use of products or materials. Source reduction can take many forms, including (1) product reuse (reusable soft drink or liquor containers), (2) consumption decrease, (3) product lifetime increases and (4) material use reduction per product manufactured. Most investigations and proposed legislation have centered on the reduction of waste from municipal sources and have not considered agricultural or mining waste sources.

Source reduction is not intended primarily to decrease the volume capacity required at a sanitary landfill. In most cases, the volume reduction would be quite small. Rather, source reduction is concerned primarily with the reduction of roadside litter (e.g., requiring reuseable beverage containers), the reduction of energy usage necessitated by the continued manufacture of products from virgin materials, and the reduced consumption of scarce virgin materials.

The State of Oregon passed a bill in October, 1972, commonly known as the Oregon Bottle Bill, which placed a deposit on all soft drink and beer containers, and banned the sale of "pull-tab" beverage containers. The motivating argument for the passage of the bill was the reduction of roadside litter and the reduction of expenditures necessitated by the cleanup of this litter. A second persuasive argument that later developed was the great energy savings realized by the sale of reuseable containers. A three-fold savings in energy usage has been estimated by using reuseable containers rather than the no deposit/no return type. For glass products, there is not a shortage of virgin materials but a large amount of energy is required to convert sand into glass. By requiring reuseable containers, the energy required for conversion can either be saved or used by other more energy dependent consumers.

In Wisconsin, over $1 million was spent on roadside litter pickup during 1973. This amount is only for state trunk highways which account for only 12% of the total highway miles in the state. Several bills have been proposed in the state legislature that have been modeled after the Oregon bill. To date these bills have seen only committee deliberation.

At the federal level, numerous attempts have been made to pass legislation to limit the generation of solid waste. Senate Bill S.2062 if enacted, would be very similar to the Oregon Bottle Bill. The Resource Conservation Act of 1973 attempted to relate to many of the areas of source reduction. The bill would regulate packaging materials so that nondegradable and nonrecyclable materials would be banned from use unless the materials would be reused. The bill also would regulate bulky items of solid waste including tires, major appliances, barrels, automobiles, construction equipment and boats. These items would be labeled specifying conditions for reuse, recycling or disposal and minimum useful life. A system of fees and penalties would be established to provide incentives for the processing of the item. Other proposed federal legislation concerning tax incentives for recycling or reuse and developing new freight rate price schedules for scrap metal are also attempts to limit the generation of solid waste. It appears that it will be at least 1-2 more years before any of these proposed bills become law.

Source reduction, like recycling, is a part of the total solid waste management process. It is a particularly difficult issue because of the many interests involved in the manufacture, distribution and sale of a product. While individual states can have an effect on certain areas (e.g., Oregon Bottle Bill) the principal institution for change in this area must be the federal government. This would provide nationwide uniformity to any source reduction programs.

Summary

The overall goal of the Wisconsin Solid Waste Management Plan is to enhance the quality, management, and protection of the state's air, water, and land resources through the development of planned programs and systems that are effective, efficient, economical, and environmentally acceptable. Emphasis has been placed on regional cooperative programs and resource conservation as well as environmentally sound waste management. State agencies have leadership roles in bringing about these solid waste management programs and systems. The Department of Natural Resources has responsibility primarily over environmental protection activities, technical assistance, and plan review. In addition, DNR works cooperatively with University of Wisconsin–Extension and Department of Local Affairs and Development in cooperative education and other programs.

Department of Natural Resources programs in solid waste management cover several major activities. Future emphases in these activities are summarized as follows:

1. Initial solid waste disposal operation licenses–emphasis on technical adequacy of site and facility designs, industrial waste disposal sites, and long-term suitability of site locations.

2. Relicensing–primary emphasis on adequacy of design and operation for large sites, and increased efficiency of relicensing procedures.

3. Enforcement–use of a wider variety of enforcement tools, prompt and efficient follow-up on enforcement actions, increased use of technical assistance in enforcement actions, and development of compliance schedules.

4. Regional programs–increased technical assistance during planning and implementation of regional systems, development of cooperative educational and technical programs with University of Wisconsin–Extension, Department of Local Affairs and Development, and the proposed Wisconsin Recycling Authority, and the encouragement of county and regional planning and systems to solve solid waste management problems and to provide for smooth transitions to recycling programs.

5. Education and training–establishment of sanitary landfill operator training programs, educational programs for professionals, and expanded cooperative education programs with University of Wisconsin–Extension and others.

6. Auto hulk management–emphasis on cooperative, comprehensive programs for auto removal, transportation, and ultimate recycling.

7. Industrial and toxic and hazardous waste management–development and implementation of comprehensive regulatory programs in toxic and hazardous waste management in coordination with industries and other Wisconsin agencies, other states, and the U.S. Environmental Protection Agency, and the implementation of comprehensive management programs for special industrial wastes such as wood wastes, sludges, foundry sands, and fly ash.

8. Management information systems–increased use of these systems to provide quantitative evaluation of solid waste programs and progress and to systematize program procedures.

9. Research–sponsor, organize, cooperate in, conduct, and review research projects in solid waste management.

Overall emphasis throughout the entire Department program will be to maintain efficient and quality program management on a continuing basis through periodic reevaluation of entire program, redefining of changing needs and priorities, and application of program planning as a continuous process.

Several major alternatives are possible for long-range additions to the State Solid Waste Management Plan. Some alternatives which would require legislation include portions of toxic and hazardous waste management, major statewide resource recovery or recycling, planning grants for county and regional systems, and mandatory county solid waste management planning. Any of these possible alternatives plus existing programs must be directed at the continued development of effective solid waste management services–storage, collection, transportation, processing, disposal, recycling, and source reduction.

Appendix •••••

1.11 GOVERNMENTAL CONSIDERATION OF ENVIRONMENTAL IMPACT. The legislature authorizes and directs that, to the fullest extent possible:

(1) The policies and regulations shall be interpreted and administered in accordance with the policies set forth in this act, and

(2) All agencies of the state shall:

(c) Include in every recommendation or report on proposals for legislation and other major actions significantly affecting the quality of the human environment, a detailed statement, substantially following the guidelines issued by the United States council on environmental quality under P.L. 91-190, 42 U.S.C. 4331, by the responsible official on:

1. The environmental impact of the proposed action;
2. Any adverse environmental effects which cannot be avoided should the proposal be implemented;
3. Alternatives to the proposed action;
4. The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and
5. Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented;
6. Such statement shall also contain details of the beneficial aspects of the proposed project, both short term and long term, and the economic advantages of the proposal.

(d) Prior to making any detailed statement, the responsible official shall consult with and obtain the comments of any agency which has jurisdiction or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate agencies, which are authorized to develop and enforce environmental standards shall be made available to the governor, the department of natural resources and to the public. Every proposal other than for legislation shall receive a public hearing before a final decision is made. Holding a public hearing as required by another statute fulfills this section. If no public hearing is otherwise required, the responsible agency shall hold the hearing in the area affected. Notice of the hearing shall be given by publishing a class 1 notice, under ch. 985, at least 15 days prior to the hearing in a newspaper covering the affected area. If the proposal has statewide significance, notice shall be published in the official state newspaper;

(e) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;

(h) Initiate and utilize ecological information in the planning and development of resource-oriented projects.

(3) All state agencies shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this act and shall propose to the governor not later than July 1, 1972, such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes, and procedures set forth in this act.

(4) Nothing in this section affects the specific statutory obligations of any agency:

(a) To comply with criteria or standards of environmental quality;

(b) To coordinate or consult with any other state or federal agency; or

(c) To act, or refrain from acting contingent upon the recommendations or certification of any other state or federal agency.

(5) The policies and goals set forth in this section are supplementary to those set forth in existing authorizations of agencies.

23.11 (5) The department [of natural resources] may require an applicant for a permit or statutory approval which the department, by order, may grant, to submit an environmental impact report if the area affected exceeds 40 acres or the estimated cost of the project exceeds $25,000.

59.07 (135) SOLID WASTE MANAGEMENT. The county board of any county may establish and operate a solid waste management system or participate in such system jointly with other counties, cities, villages or towns. For this purpose, the county board may exercise the following powers:

(a) Develop plans for a solid waste management system.

(b) Within such county or joint county, collect, transport, dispose of, destroy or transform wastes, including, without restriction because of enumeration, garbage, ashes, or incinerator residue, municipal, domestic, agricultural, industrial and commercial rubbish, waste or refuse material, including explosives, pathological wastes, chemical wastes, herbicide and pesticide wastes.

(c) Acquire lands by purchase, lease, donation or eminent domain, within the county, for use in the solid waste management system.

(d) Authorize employes or agents to enter upon lands to conduct reasonable and necessary investigations and tests to determine the suitability of sites for solid waste management activities whenever permission is obtained from the property owner.

(e) Acquire by purchase, lease, donation or eminent domain such easements or other limited interests in lands as are desired or needed to assure compatible land uses in the environs of any site that is part of the solid waste disposal system.

(f) Establish operations and methods of waste management as are deemed appropriate. Waste burial operations shall be in accordance with sanitary landfill methods and the sites shall, insofar as practicable, be restored and made suitable for attractive recreational or productive use upon completion of waste disposal operations.

(g) Acquire necessary equipment, use equipment and facilities of the county highway agency, and construct, equip and operate incinerators or other structures to be used in the solid waste management system.

(h) Adopt and enforce ordinances necessary for the conduct of the solid waste management system and provide forfeitures for violations.

(i) Contract with private collectors or transporters or municipalities to receive and dispose of wastes.

(j) Engage in, sponsor or cosponsor research and demonstration projects intended to improve the techniques of solid waste management or to increase the extent of reuse or recycling of materials and resources included within the wastes.

(k) Accept funds derived from state or federal grant or assistance programs and enter into necessary contracts or agreements.

(l) Appropriate funds and levy taxes to provide funds for acquisition or lease of sites, easements, necessary facilities and equipment and for all other costs required for the solid waste management system except that no town, city or village which operates its own waste collection and disposal facility, or property therein, shall be subject to any tax levied hereunder to cover the cost of operation of these functions. Such appropriations may be treated as a revolving capital fund to be reimbursed from proceeds of the system.

(m) Make payments to any municipality in which county disposal sites or facilities are located to cover the reasonable costs of services rendered to such sites or facilities.

(n) Charge or assess reasonable fees, approximately commensurate with the costs of services rendered to persons using the services of the county solid waste management system. Fees may include a reasonable charge for depreciation which shall create a reserve for future capital outlays for waste disposal facilities or equipment. All assessments for liquid waste shall be assessed by volume.

(o) Districts may be created and different types of solid waste collection or disposal services provided within them and different regulations and cost allocations may be applied to each service district. Costs allocated to such service districts may be provided by general tax upon the property of the respective districts or by allocation of charges to the cities, villages or towns whose territory is included within such districts.

(p) Utilize or dispose of by sale or otherwise any and all products or by-products of the solid waste management system.

60.72 GARBAGE DUMPING REGULATED. (1) No person or municipality shall transport any garbage, rubbish or other refuse into or within any town for the purpose of dumping or otherwise disposing of the same until such person or municipality has first secured a permit to do so from the town board. This section shall not apply where the city or village owns its own dumping or disposal ground and confines its dumping or disposal to the use of the sanitary landfill method or incineration on such grounds if such disposal is conducted in a sanitary manner satisfactory to the department of natural resources and on a site approved by the department and such use is not contrary to any town or county zoning regulation.

(2) Any person or municipality who shall violate any provision of this section shall be punished by a fine of not less than $5 nor more than $100, or by imprisonment in the county jail for not more than 6 months, or by both such fine and imprisonment.

66.067 PUBLIC WORKS PROJECTS. For financing purposes, garbage incinerators, toll bridges, swimming pools, tennis courts, parks, playgrounds, golf links, bathing beaches, bathhouses, street lighting, city halls, courthouses, jails, schools, hospitals, homes for the aged or indigent, regional projects, waste collection and disposal operations, systems of sewerage and any and all other necessary public works projects undertaken by any town, village, city, county, other municipality, or a commission created by contract under s. 66.30, are public utilities within the meaning of s. 66.066. In financing under that section, rentals and fees shall be considered as revenue. Any indebtedness created pursuant to this section shall not be included in arriving at the constitutional debt limitation.

SECTION 1. STATEMENT OF POLICY AND PURPOSES. (1) The high level of production required to meet the varied needs of an expanding population and high standard of living has resulted in a sharp rise in the amount of waste materials discarded annually.

(2) Inefficient and improper methods of waste disposal have caused an ever increasing pollution of our vital air, land and water resources threatening the utility of our resources and the quality of the environment in which we live. The problems of waste disposal endanger the public health, safety and welfare, create public nuisances, result in scenic blight and adversely affect land values.

(3) The close interrelationship of air, land and water pollution requires concerted action to prevent the worsening of these problems. A problem in solid waste disposal will not be solved by creating air pollution, nor will a problem in air pollution be solved by intensifying the problems of water pollution. Immediate remedial action is needed to protect our valuable resources.

(4) It is the purpose of this act to grant the necessary powers to organize a comprehensive program to enhance the quality, management and protection of the state's air and land resources. Recognizing the need for a coordinated effort to prevent and abate all kinds of environmental pollution, it is the intention of this act to vest authority for the state-wide control of air pollution and solid waste disposal in the same state agency which has general supervision and control over the waters of the state.

(5) In order to achieve the policy objectives of this act, it is the express policy of the state to mobilize governmental effort and resources at all levels, allocating such effort and resources to attain the maximum benefit for the people of the state as a whole.

144.01 DEFINITIONS. The following terms as used in this chapter mean:

(1) "Waters of the state" includes those portions of Lake Michigan and Lake Superior within the boundaries of Wisconsin, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other surface or ground water, natural or artificial, public or private, within the state or its jurisdiction.

(2) "Sewage", the water carried wastes created in and to be conducted away from residences, industrial establishments, and public buildings as defined in s. 101.01 (2), with such surface or ground water as may be present.

(3) "Waterworks", or "water system", all structures, conduits and appurtenances by means of which water is delivered to consumers except piping and fixtures inside buildings served, and service pipes from building to street main.

(4) "Water supply", the sources and their surroundings from which water is supplied for drinking or domestic purposes.

(5) "Sewerage system", all structures, conduits and pipe lines by which sewage is collected and disposed of, except plumbing inside and in connection with buildings served, and service pipes from building to street main.

(6) "System or plant" includes water and sewerage systems and sewage and refuse disposal plants.

(7) "Refuse", all matters produced from industrial or community life, subject to decomposition, not defined as sewage.

(8) "Owner", the state, county, town, town sanitary district, city, village, metropolitan sewerage district, corporation, firm, company, institution or individual owning or operating any water supply, sewerage or water system or sewage and refuse disposal plant.

(9) "Industrial wastes" include liquid or other wastes resulting from any process of industry, manufacture, trade or business or the development of any natural resource.

(10) "Other wastes" include all other substances, except industrial wastes and sewage, as the latter term is defined in s. 144.01, which pollute any of the surface waters of the state. The term also includes "unnecessary siltation" resulting from operations such as the washing of vegetables or raw food products, gravel washing, stripping of lands for development of subdivisions, highways, quarries and gravel pits, mine drainage, cleaning of vehicles or barges or gross neglect of land erosion.

(11) "Pollution" includes contaminating or rendering unclean or impure the waters of the state, or making the same injurious to public health, harmful for commercial or recreational use, or deleterious to fish, bird, animal or plant life.

(12) "Municipality", any city, town, village, county, county utility district, town sanitary district or metropolitan sewage district.

(13) "Nonprofit-sharing corporation", a nonstock corporation organized under ch. 181 or corresponding prior general corporation laws.

(14) "Department", the department of natural resources.

(15) "Secretary", the secretary of natural resources.

144.30 DEFINITIONS. As used in this chapter:

(1) "Air contaminant" means dust, fumes, mist, liquid, smoke, other particulate matter, vapor, gas, odorous substances or any combination thereof but shall not include uncombined water vapor.

(2) "Air pollution" means the presence in the atmosphere of one or more air contaminants in such quantities and of such duration as is or tends to be injurious to human health or welfare, animal or plant life, or property, or would unreasonably interfere with the enjoyment of life or property.

(3) "Emission" means a release of air contaminants into the atmosphere.

(4) "Solid waste" means garbage, refuse and other discarded or salvageable solid materials, including solid-waste materials resulting from industrial, commercial and agricultural operations, and from domestic use and public service activities, but does not include solids or dissolved material in waste water effluents or other common water pollutants.

(5) "Garbage" means discarded materials resulting from the handling, processing, storage and consumption of food.

(6) "Refuse" means combustible and noncombustible rubbish, including, but not limited to, paper, wood, metal, glass, cloth and products thereof; litter and street rubbish, ashes; and lumber, concrete and other debris resulting from the construction or demolition of structures.

(7) "Solid waste disposal" means the collection, storage treatment, utilization, processing or final disposal of solid waste.

(8) "Solid waste disposal sites and facilities" include commercial and municipal establishments such as, without limitation because of enumeration, dumps, incinerator sites, auto junkyards and scrap metal salvage yards.

(9) "Environmental pollution" means the contaminating or rendering unclean or impure the air, land or waters of the state, or making the same injurious to public health, harmful for commercial or recreational use, or deleterious to fish, bird, animal or plant life.

(10) "Toxic and hazardous substances" means waste materials such as pesticides, acids, caustics, pathological wastes, radioactive materials, flammable or explosive materials and similar chemicals and harmful wastes which require special handling and disposal to protect and conserve the environment.

(11) "Solid waste management" means planning, organizing, financing, and implementing programs to effect the storage, collection, transporting, processing, recycling or final disposal of solid wastes in a sanitary, nuisance-free manner.

(12) "Solid waste management plan" means a plan prepared to provide for solid waste management.

144.31 GENERAL POWERS AND DUTIES. (1) The department shall:

(a) Promulgate rules implementing and consistent with ss. 144.30 to 144.46 and 144.54.

(b) Encourage voluntary cooperation by persons and affected groups to achieve the purposes of ss. 144.30 to 144.46 and 144.54.

(c) Encourage local units of government to handle air pollution and solid waste disposal problems within their respective jurisdictions and on a regional basis, and provide technical and consultative assistance therefor.

(d) Collect and disseminate information and conduct educational and training programs relating to the purposes of ss. 144.30 and 144.46 and 144.54.

(e) Organize a comprehensive and integrated program to enhance the quality, management and protection of the state's air, land and water resources.

(2) The department may:

(a) Hold hearings relating to any aspect of the administration of ss. 144.30 to 144.46 and 144.54 and, in connection therewith, compel the attendance of witnesses and the production of evidence.

(b) Issue orders to effectuate the purposes of ss. 144.30 to 144.46 and 144.54 and enforce the same by all appropriate administrative and judicial proceedings.

(c) Secure necessary scientific, technical, administrative and operational services, including laboratory facilities, by contract or otherwise.

(d) Make a continuing study of the effects of the emission of air contaminants from motor vehicles on the quality of the outdoor atmosphere and make recommendations to appropriate public and private bodies with respect thereto.

(e) Advise, consult, contract and cooperate with other agencies of the state, local governments, industries, other states, interstate or interlocal agencies, and the federal government, and with interested persons or groups.

144.32 FEDERAL AID. Subdivisions of this state and interlocal agencies may make application for, receive, administer and expend any federal aid for the control of air pollution or the development and administration of programs related to air pollution control and solid waste disposal sites and facilities if first submitted to and approved by the department. The department shall approve and sucy application if it is consistent with the purposes of ss. 144.30 to 144.46 and any other applicable requirements of law.

144.33 CONFIDENTIALITY OF RECORDS. Any records or other information furnished to or obtained by the department in the administration of ss. 144.30 to 144.46 and 144.54, which records or information, as certified by the owner or operator, relate to production or sales figures or to processes or production unique to the owner or operator or which would tend to affect adversely the competitive position of such owner or operator, shall be only for the confidential use of the department in the administration of ss. 144.30 to 144.45 and 144.54, unless such owner or operator expressly agrees to their publication or availability to the general public. Nothing herein shall prevent the use of such records or information by the department in compiling or publishing analyses or summaries relating to the general condition of the outdoor atmosphere, if such analyses or summaries do not identify any owner or operator or reveal any information otherwise confidential under this section.

144.34 INSPECTIONS. Any duly authorized officer, employe or representative of the department may enter and inspect any property, premise or place on or at which an air contaminant source or solid waste disposal site or facility is located or is being constructed or installed at any reasonable time for the purpose of ascertaining the state of compliance with ss. 144.30 to 144.46 and 144.54 and rules in force pursuant thereto. No person shall refuse entry or access to any such authorized representative of the department who requests entry for purposes of inspection, and who presents appropriate credentials; nor shall any person obstruct, hamper or interfere with any such inspection. The department, if requested, shall furnish to the owner or operator of the premises a report setting forth all facts found which relate to compliance status.

144.35 VIOLATIONS: ENFORCEMENT. (1) (a) Whenever the department has reason to believe that a violation of ss. 144.30 to 144.46 and 144.54 or any rule pursuant thereto has occurred, it may cause written notice to be served upon the alleged violator. The notice shall specify the law or rule alleged to be violated, and contain the findings of fact on which the charge of violation is based, and may include an order that necessary corrective action be taken within a reasonable time. Any such order shall become effective unless, no later than 10 days after the date the notice and order are served, the person named therein requests in writing a hearing before the department. Upon such request, the department shall after due notice hold a hearing. In lieu of an order, the department may require that the alleged violator appear before the department for a hearing at a time and place specified in the notice and answer the charges complained of, or the department may initiate action under s. 144.57.

(b) If after such hearing the department finds that a violation has occurred, it shall affirm or modify its order previously issued, or issue an appropriate order for the prevention, abatement or control of the problems involved or for the taking of such other corrective action as may be appropriate. If the department finds that no violation has occurred, it shall rescind its order. Any order issued as part of a notice or after hearing may prescribe one or more dates by which necessary action shall be taken in preventing, abating or controlling the violation.

144.36 AIR POLLUTION CONTROL POWERS AND DUTIES. (1) The department shall:

(a) Prepare and develop one or more comprehensive plans for the prevention, abatement and control of air pollution in this state. The department thereafter shall be responsible for the revision and implementation of such plans.

(b) Conduct or direct studies, investigations and research relating to air contamination and air pollution and their causes, effects, prevention, abatement and control and, by means of field studies and sampling, determine the degree of air contamination and air pollution throughout the state.

(c) Consult, upon request, with any person proposing to construct, install, or otherwise acquire an air contaminant source, device or system for the control thereof, concerning the efficacy of such device or system, or the air pollution problem which may be related to the source, device or system. Nothing in any such consultation shall relieve any person from compliance with ss. 144.30 to 144.46 or rules pursuant thereto, or any other provision of law.

(2) The department may examine any records relating to emissions which cause or contribute to air contamination.

144.37 AIR POLLUTION CONTROL COUNCIL. The air pollution control council shall advise the natural resources board on proposed and existing rules and any matters pertaining to air pollution.

144.38 CLASSIFICATION AND REPORTING. (1) (a) The department, by rule, shall classify air contaminant sources which may cause or contribute to air pollution, according to levels and types of emissions and other characteristics which relate to air pollution, and may require reporting for any such class. Classifications made pursuant to this section may be for application to the state as a whole or to any designated area of the state, and shall be made with special reference to effects on health, economic and social factors, and physical effects on property.

(b) Any person operating or responsible for the operation of air contaminant sources of any class for which the rules of the department require reporting shall make reports containing such information as the department requires concerning location, size and heights of contaminant outlets, processes employed, fuels used and the nature and time periods of duration of emissions, and such other information as is relevant to air pollution and available or reasonably capable of being assembled.

144.39 NOTICE REQUIRED FOR CONSTRUCTION. (1) The department shall require that notice be given to it prior to the construction, installation or establishment of particular types or classes of air contaminant sources specified in its rules. Within 15 days after receipt of such notice, the department shall require, as a condition precedent to the construction, installation or establishment of the air contaminant source covered thereby, the submission of plans, specifications and such other information as it deems necessary in order to determine whether the proposed construction, installation or establishment will be in accordance with applicable rules in force pursuant to ss. 144.30 to 144.46. If within 30 days after the receipt of such plans, specifications or other information the department determines that the proposed construction, installation or establishment will not be in accordance with the requirements of ss. 144.30 to 144.46 or applicable rules, it shall issue an order prohibiting the construction, installation or establishment of the air contaminant source. If the department does not issue such order within such 30-day period the construction, installation or establishment may proceed in accordance with the plans, specifications or other information, if any, required to be submitted.

(2) In lieu of state view of plans and specifications, the department may authorize counties which are administering approved air pollution control programs to review and approve plans and specifications of air contaminant sources being constructed within the jurisdiction of said counties.

(3) In addition to any other remedies available on account of the issuance of an order prohibiting construction, installation or establishment of such source, and prior to invoking any such remedies, any person aggrieved thereby shall, upon request in accordance with rules of the department, be entitled to a hearing on the order. Following such hearing, the order may be affirmed, modified or withdrawn.

(4) Any addition to or enlargement or replacement of an air contaminant source, or any major alteration therein, shall be construed as construction, installation or establishment of a new air contaminant source.

(5) Any features, machines and devices constituting parts of or called for by plans, specifications or other information submitted pursuant to sub. (1) shall be maintained in good working order.

(6) Nothing in this section authorizes the department to require the use of machinery, devices or equipment from a particular supplier or produced by a particular manufacturer, if the required performance standards may be met by machinery, devices or equipment otherwise available.

(7) The absence of or failure to issue a rule, or oder pursuant to this section does not relieve any person from compliance with any emission control requirements or with any other provision of law.

(8) The department may by rule prescribe and provide for the payment and collection of reasonable fees for the review of plans and specifications required to be submitted pursuant to this section.

144.40 EMERGENCY PROCEDURE. (1) If the secretary finds that a generalized condition of air pollution exists and that it creates an emergency requiring immediate action to protect human health or safety, he shall order persons causing or contributing to the air pollution to reduce or discontinue immediately the emission of air contaminants, and such order shall fix a place and time, not later than 24 hours thereafter, for a hearing to be held before the department. Not more than 24 hours after the commencement of such hearing, and without adjournment thereof, the natural resources board shall affirm, modify or set aside the order of the secretary.

(2) In the absence of a generalized condition of air pollution of the type referred to in sub. (1), if the secretary finds that emissions from the operation of one or more air contaminant sources is causing imminent danger to human health or safety, he may order the persons responsible for the operations in question to reduce or discontinue emissions immediately, without regard to s. 144.35. In such event, the requirements for hearing and affirmance, modification or setting aside of orders set forth in sub. (1) shall apply.

144.41 LOCAL AIR POLLUTION CONTROL PROGRAMS. (1) After consultation with incorporated units of local government, any county may establish and thereafter administer within its jurisdiction, including incorporated areas, an air pollution control program which:

(a) Provides by ordinance for requirements compatible with, or stricter or more extensive than those imposed by ss. 144.30 to 144.46 and rules issued thereunder. Such ordinances shall supersede any existing local ordinances;

(b) Provides for the county-wide enforcement of such requirements by appropriate administrative and judicial process;

(c) Provides for administrative organization, staff and financial and other resources necessary to effectively and efficiently carry out its program;

(d) May authorize municipalities to participate in the administration and enforcement of air pollution programs; and

(e) Is approved by the department as adequate to meet the requirements of ss. 144.30 to 144.46 and any applicable rules pursuant thereto.

(2) Any county may consult with regional planning commissions and may administer all or part of its air pollution control program in cooperation with one or more other counties or municipalities. Performance by or on behalf of a county pursuant to such cooperative undertaking shall be considered to be performance by the county for purposes of this section.

(3) If the department finds that the location, character or extent of particular concentrations of population, air contaminant sources, the geographic, topographic or meteorological considerations, or any combinations thereof, are such as to make impracticable the maintenance of appropriate levels of air quality without an area-wide air pollution control program, the department may determine the boundaries within which such program is necessary and require it.

(4) (a) If the department has reason to believe that the absence of an air pollution control program or a program in force pursuant to this section is inadequate to prevent and control air pollution in the jurisdiction to which such program relates, or that such program is being administered in a manner inconsistent with the requirements of ss. 144.30 to 144.46, the department shall, on due notice, conduct a hearing on the matter.

(b) If, after such hearing, the department determines that a program is required or is inadequate to prevent and control air pollution in the county to which such program relates, or that such program is not accomplishing the purposes of ss. 144.30 to 144.46, it shall require that necessary corrective measures be taken within a reasonable period of time, not to exceed 60 days.

(c) If the county fails to take such necessary corrective action within the time required, the department shall administer within such county all of the regulatory provisions of ss. 144.30 to 144.46. Such air pollution control program shall supersede all county air pollution regulations, ordinances and requirements in the affected jurisdiction. The cost of such administration shall be a charge on the county.

(5) Any county in which the department administers its air pollution control program under sub. (4) may, with the approval of the department, establish or resume a county air pollution control program which meets the requirements of sub. (1).

(6) Nothing in ss. 144.30 to 144.46 supersedes the jurisdiction of any county air pollution control program in operation on July 26, 1967, but any such program shall meet all requirements of ss. 144.30 to 144.46 for a county air pollution control program. Any approval required from the department shall be deemed granted unless the department takes specific action to the contrary.

144.415 STATE AID. (1) The department may develop a program for the training of technical personnel to facilitate the administration of county air pollution control programs. Annual grants-in-aid may be made by the department to any county or group of counties for the training of employes or potential employes in air pollution detection and control. The qualifications and criteria for participation in this program shall be established by the department.

(2) The department may enter into agreements with any county to provide in-service training programs and facilities for the purpose described in sub. (1). In accordance with criteria established by the department, annual grants-in-aid may be made by the department to any county establishing an approved in-service training program for the costs of developing and maintaining such program.

144.42 MOTOR VEHICLE POLLUTION. (1) As the state of knowledge and technology relating to the control of emissions from motor vehicles may permit or make appropriate, and in furtherance of the purposes of ss. 144.30 to 144.46, the department may provide by rule for the control of emissions from motor vehicles. Such rules may prescribe requirements for the installation and use of equipment designed to reduce or eliminate emissions and for the proper maintenance of such equipment and vehicles. Any rules pursuant to this section shall be consistent with provisions of federal law, if any, relating to control of emissions from the vehicles concerned. The department shall not require, as a condition precedent to the initial sale of a vehicle or vehicular equipment, the inspection, certification or other approval of any feature or equipment designed for the control of emissions from motor vehicles, if such feature or equipment has been certified, approved or otherwise authorized pursuant to federal law.

(2) Except as permitted or authorized by law, no person shall fail to maintain in good working order or remove, dismantle or otherwise cause to be inoperative any equipment or feature constituting an operational element of the air pollution control system or mechanism of a motor vehicle and required by rules of the department to be maintained in or on the vehicle. Any such failure to maintain in good working order or removal, dismantling or causing of inoperability shall subject the owner or operator to suspension or cancellation of the registration for the vehicle. The vehicle shall not thereafter be eligible for registration until all parts and equipment constituting operational elements of the motor vehicle have been restored, replaced or repaired and are in good working order.

(3) The department shall consult with the division of motor vehicles and furnish it with technical information, including testing techniques, standards and instructions for emission control features and equipment.

(4) In this section "motor vehicle" has the meaning designated in s. 340.01 (35).

144.421 MERCURY USERS. Every owner of an establishment using 50 pounds or more of mercury compounds or metallic mercury in any one year shall furnish the department with a materials balance statement for the mercury compound or metallic mercury. Such statement shall itemize the type and amount of mercury compound or metallic mercury used, the processes used in and the means by and the place where it is disposed. The statement shall be on a form prescribed by the department and shall be filed each January 1 for the preceding year.

144.422 AIR STANDARDS FOR MERCURY. The department shall, no later than 6 months after April 29, 1972, prepare and adopt minimum standards for the emission of mercury compounds or metallic mercury into the air.

144.423 MERCURY DISCHARGE INTO WATER. Discharge of mercury compounds and metallic mercury into the waters of this state by any person shall be limited to fifteen-hundredths of a pound of mercury per day averaged over a 30-day period, and not more than one-half pound in any one day. The department may establish lower maximum discharge limits by rule.

144.43 SOLID WASTE DISPOSAL STANDARDS. The department shall, no later than January 1, 1969, prepare and adopt minimum standards for the location, design, construction, sanitation, operation and maintenance of solid waste disposal sites and facilities and shall, following a public hearing, adopt such rules relating to the operation and maintenance of solid waste disposal sites and facilities as it deems necessary.

144.435 SOLID WASTE MANAGEMENT. (1) Each county board individually or jointly with another county board may prepare and adopt a county solid waste management plan consistent with state criteria.

(2) All county plans shall be submitted to the department of local affairs and development for review. Within 90 days after submittal, the department of local affairs and development shall transmit the plans and its recommendations to the department of natural resources for approval. During its review, the department of local affairs and development may consult with the appropriate regional planning commission to determine whether any site use and operation is not in conflict with any plans adopted by the commission.

144.437 SOLID WASTE MANAGEMENT CRITERIA. The department of local affairs and development shall by rule adopt county solid waste management criteria for the development of the plans permitted under s. 144.435.

144.44 LICENSE. (1) After the department has promulgated minimum standards for the location, design, construction, operation and maintenance of solid waste disposal sites and facilities, no person shall establish, maintain, conduct or operate a solid waste disposal site or facility which does not adhere to such minimum standards. Such sites or facilities shall be licensed annually by the department providing they comply with said standards. The department may charge a reasonable fee for the costs of administering this section.

(2) Nothing in ss. 144.30 to 144.46 shall limit the authority of any local governing body to issue licenses and permits for any state-licensed sites or facilities or to adopt, subject to department approval, standards for the location, design, construction, operation and maintenance of solid waste disposal sites and facilities more restrictive than those adopted by the state under this section.

144.445 LOCAL PERMITS NOT REQUIRED; DEPARTMENTAL LICENSE. (1) Any site which meets all state standards and is to be operated either by a governmental jurisdiction or combination thereof engaged in solid waste management in accordance with an approved county plan shall not be required to obtain any local permits or authorization.

(2) (a) Notwithstanding s. 144.44 (2), if a solid waste disposal site designed to serve a county or 2 or more municipalities is otherwise eligible for licensing except for failure to obtain a local permit, the department may, after notice and hearing, issue a license under s. 144.44 for the operation of said site. In issuing said license the department must find that the requirements of public health, safety and welfare require the waiver of local approvals as a condition precedent to issuance of a license.

(b) Any license issued under this section shall supersede all local requirements. However, operations licensed under this section may be required to render payments in lieu of local license or permit fees to the municipality in whose jurisdiction they lie not to exceed $100 per site per year.

144.45 RESEARCH. The department may conduct or direct scientific experiments, investigations, demonstration grants and research on any matter relating to solid waste disposal, including, but not limited to, landfill, disposal and utilization of junked vehicles, and production of compost.

144.46 SHORELAND AND FLOOD PLAIN ZONING. Solid waste disposal sites and facilities are prohibited within areas under the jurisdiction of shoreland and flood plain zoning regulations adopted pursuant to ss. 59.971 and 87.30, except that the department may issue permits authorizing sites and facilities in such areas.

144.536 ENFORCEMENT OF ORDERS; DUTY OF DEPARTMENT OF JUSTICE; EXPENSES. All orders of the department shall be enforced by the attorney general. The circuit court of Dane county or any other county where violation of such an order has occurred in whole or in part shall have jurisdiction to enforce the order by injunctional and other relief appropriate to the enforcement of the order. For purposes of such proceeding where the order prohibits in whole or in part any pollution, a violation thereof shall be deemed a public nuisance. The expenses incurred by the department of justice in assisting with the administration of ch. 144 shall be charged to the appropriation made by s. 20.370 (5).

144.537 HEARINGS; PROCEDURE; REVIEW. The department shall hold a public hearing relating to alleged or potential environmental pollution upon the verified complaint of 6 or more citizens filed with the department. The complaint shall state the name and address of a person within the state authorized to receive service of answer and other papers in behalf of complainants. The department may order the complainants to file security for costs in a sum deemed to be adequate but not to exceed $100 within 20 days after the service upon them of a copy of such order and all proceedings on the part of such complainants shall be stayed until security is filed. The department shall serve a copy of the complaint and notice of the hearing upon the alleged or potential polluter either personally or by registered mail directed to his last known post-office address at least 20 days prior to the time set for the hearing which shall be held not later than 90 days from the filing of the complaint. The respondent shall file his verified answer to the complaint with the department and serve a copy on the person so designated by the complainants not later than 5 days prior to the date set for the hearing, unless the time for answering is extended by the department for cause shown. For purposes of any hearing under this chapter, the secretary may issue subpoenas and administer oaths. Within 90 days after the closing of the hearing, the department shall make and file its findings of fact, conclusions of law and order, which shall be subject to review under ch. 227. If the department determines that any complaint has been filed maliciously or in bad faith it shall so find, and the person complained against shall be entitled to recover his expenses on the hearing in a civil action. Any situation, project or activity which upon continuance or implementation would cause, beyond reasonable doubt, a degree of pollution that normally would require clean-up action if it already existed, shall be considered potential environmental pollution.

342.40 VEHICLE ABANDONMENT PROHIBITED; REMOVAL; DISPOSAL. (1) No person shall leave unattended any motor vehicle, trailer, semitrailer, or mobile home on any public highway or private or public property, for such time and under such circumstances as to cause the vehicle to reasonably appear to have been abandoned. Whenever any vehicle has been left unattended without the permission of the property owner for more than 48 hours in cities of the 1st class and, in other cities, villages and towns, a period set by the governing body thereof, the vehicle is deemed abandoned and constitutes a public nuisance.

(2) Any vehicle in violation of this section shall be impounded until lawfully claimed or disposed of under sub. (3) except that if a duly authorized municipal or county representative determines that the cost of towing and storage charges for the impoundment would exceed the value of the vehicle, the vehicle may be junked by the municipality or county prior to expiration of the impoundment period upon determination by the chief of police or sheriff having jurisdiction that the vehicle is not wanted for evidence or other reason.

(3) Any municipality or county may enact ordinances governing the removal and disposal of abandoned vehicles and provide a forfeiture in addition to providing for the recovery by the municipality or county of the cost of impounding and disposing of the vehicle.

(a) Any municipality or university police officer, sheriff's deputy, county traffic patrolman, state traffic officer or conservation warden who discovers any motor vehicle, trailer, semitrailer, or mobile home on any public highway or private or public property which has been abandoned shall cause the vehicle to be removed to a suitable place of impoundment. Upon removal of the vehicle the officer or warden shall notify the sheriff or chief of police of the abandonment and of the location of the impounded vehicle.

(b) The owner of any abandoned vehicle except a stolen vehicle is responsible for the abandonment and all costs of impounding and disposing of the vehicle. Costs not recovered from the sale of the vehicle may be recovered in a civil action by the municipality against the owner.

(c) Any abandoned vehicle which is determined by a duly authorized municipal or county representative to have a value in excess of $100 shall be retained in storage for a period of 14 days after certified mail notice has been sent to the owner and lienholders of record to permit reclamation of the vehicle after payment of accrued charges. Thereafter the municipality or county may dispose of the vehicle by sale as provided by ordinance.

(d) Any abandoned vehicle which is determined by a duly authorized municipal or county representative to have a value less than $100 may be disposed of by direct sale to a licensed salvage dealer upon determination that the vehicle is not reported stolen.

(e) Within 5 days after the sale or disposal of a vehicle as provided in par. (c) or (d), the municipality or county shall advise the division of the sale or disposition on form supplied by the division.

WISCONSIN ADMINISTRATIVE CODE

NATURAL RESOURCES

Chapter NR 151

SOLID WASTE MANAGEMENT

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History: Prior to May, 1971 similar rules, sections RD 51.01—RD 51.21, were to be found in chapter RD 51. In May, 1971 chapter RD 51 was renumbered to be chapter NR 151. Chapter NR 151 as it existed on June 30, 1973 was repealed, and a new chapter NR 151 was created. Register, June, 1973, No. 211, eff. 7-1-73.

FOREWORD

The high level of production required to meet the varied needs of an expanding population and high standard of living has resulted in a sharp rise in the amount of waste materials discarded annually. Inefficient and improper methods of waste disposal have caused an increasing pollution of our vital air, land and water resources threatening the utility of our resources and the quality of the environment in which we live. The problems of improper waste disposal endanger the public health, safety and welfare, create public nuisances, result in scenic blight and adversely affect land values. The close interrelationship of air, land and water pollution requires concerted action to prevent the worsening of these problems.

It is the intent of these rules to provide for the handling, processing, and ultimate disposal of solid waste in such a way as to make efficient, nuisance-free, environmentally acceptable waste management a reality in Wisconsin.

The department encourages cooperation of municipalities which may adopt this chapter for use in local laws, ordinances or regulations.

These rules were adopted by the department pursuant to sections 144.43 and 144.44, Wis. Stats.:

144.43 Solid waste disposal standards. The department shall, no later than January 1, 1969, prepare and adopt minimum standards for the location, design, construction, sanitation, operation and maintenance of solid waste disposal sites and facilities and shall, following a public hearing, adopt such rules relating to the operation and maintenance of solid waste disposal sites and facilities as it deems necessary.

144.44 License. (1) After the department has promulgated minimum standards for the location, design, construction, operation and maintenance of solid waste disposal sites and facilities, no person shall establish, maintain, conduct or operate a solid waste disposal site or facility which does not adhere to such minimum standards. Such sites or facilities shall be licensed annually by the department providing they comply with said standards. The department may charge a reasonable fee for the costs of administering this section.

(2) Nothing in ss. 144.30 to 144.46, Wis. Stats., shall limit the authority of any local governing body to issue licenses and permits for any state-licensed sites or facilities or to adopt, subject to department approval, standards for the location, design, construction, operation and maintenance of solid waste disposal sites and facilities more restrictive than those adopted by the state under this section.

NR 151.01 Applicability. The provisions of this chapter govern the storage, collection, transportation, treatment, utilization, processing, and final disposal of solid waste by any person or municipality, and the licensing of solid waste disposal sites and facilities in keeping with sections 144.43 and 144.44, Wis. Stats.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.02 Definitions. For the purpose of these regulations: (1) AIR CURTAIN DESTRUCTOR. An air curtain destructor is a solid waste disposal operation that combines a fixed wall open pit and a mechanical air supply which uses an excess of oxygen and turbulence to accomplish the smokeless combustion of clean wood wastes and similar combustible materials.

(2) COLLECTING AND TRANSPORTING SERVICE. A collecting and transporting service is a solid waste disposal operation which utilizes containers and/or vehicles for the collection and transportation of solid waste for disposal purposes.

(3) COMPOSTING OPERATION. A composting operation is a solid waste disposal operation for the controlled, accelerated, biological decomposition of solid waste.

(4) DEPARTMENT. The department is the department of natural resources.

(5) GARBAGE. Garbage means discarded materials resulting from the handling, processing, storage and consumption of food.

(6) INCINERATOR. An incinerator is a solid waste disposal operation designed and operated for controlled burning of wastes, to achieve volume and weight reduction.

(7) LAND DISPOSAL OPERATION. A land disposal operation is a solid waste disposal operation where solid waste is deposited on land by utilizing the principles of engineering to confine the waste to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth on a regular schedule.

(8) NONCOMBUSTIBLE MATERIAL. Noncombustible material is solid waste which is incapable of supporting combustion in the ambient atmosphere.

(9) OPEN BURNING. Open burning is combustion wherein the products are emitted directly into the ambient air without passing through a stack or chimney. Open burning does not include the combustion occurring at a properly operated air curtain destructor.

(10) POPULATION EQUIVALENT. Population equivalent is the population equal to the sum of the population of the geographical area based on the most recent census data, or department of administration census data used for tax sharing purposes, plus the seasonal population not included in the census data, plus one person per 1,000 pounds per year of industrial, commercial, and agricultural waste.

(11) PROCESSED SOLID WASTE. Processed solid waste is solid waste that has been incinerated, pulverized, shredded, classified, baled, separated, or altered by some means in a solid waste processing plant.

(12) REFUSE. Refuse means combustible and noncombustible rubbish, including, but not limited to paper, wood, metal, glass, cloth, and products thereof; litter and street rubbish, ashes; and lumber, con-

crete and other debris resulting from the construction or demolition of structures.

(13) SALVAGEABLE MATERIAL. Salvageable material is material which is of further usefulness only as raw material for reprocessing or as imperfect stock from which replacement or spare parts can be extracted.

(14) SALVAGE YARD. A salvage yard is a solid waste disposal operation at which salvageable materials are stored or sold or at which wrecking, dismantling or demolition of salvageable materials are conducted. A solid waste recycling center is not considered a salvage yard.

(15) SANITARY LANDFILL. Sanitary landfill is a type of land disposal operation involving the disposal of solid waste on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the solid waste to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operation, or at such more frequent intervals as may be necessary.

(16) SERVE. To provide or to make available a solid waste disposal operation.

(17) SOLID WASTE. Solid waste means garbage, refuse and all other discarded or salvageable solid materials, including solid waste materials resulting from industrial, commercial, and agricultural operations, and from domestic use and public service activities, but does not include solids or dissolved material in waste water effluents or other common water pollutants.

(18) SOLID WASTE DISPOSAL. Solid waste disposal means the collection, storage, treatment, utilization, processing or final disposal of solid waste.

(19) SOLID WASTE DISPOSAL OPERATION. A solid waste disposal operation is the operation or maintenance of a solid waste disposal site or facility, for the collection, storage, utilization, processing, or final disposal of solid waste, including, but not limited to, land disposal, incineration, transfer, air curtain destruction, composting, reduction, shredding, compression, processing, and salvage. In house reuse of imperfect finished products to make a merchantable finished product is not a solid waste disposal operation.

(20) SOLID WASTE MANAGEMENT. Solid waste management is planning, organizing, and implementing programs to effect the storage, collection, transportation, processing, utilization or final disposal of solid wastes.

(21) SOLID WASTE PROCESSING PLANT. A solid waste processing plant is a solid waste disposal operation at which solid waste is incinerated, pulverized, shredded, classified, baled, separated or altered by some other means to facilitate transportation, utilization, or disposal.

(22) SOLID WASTE RECYCLING CENTER. A solid waste recycling center is a solid waste disposal operation at which temporary storage and processes such as baling of paper, grinding of glass, and flattening of cans, are conducted on segregated solid waste to facilitate reuse of the segregated solid waste as raw material.

(23) TOXIC OR HAZARDOUS WASTES. Toxic or hazardous wastes are solid wastes such as pesticides, acids, caustics, pathological wastes, radioactive materials, flammable or explosive materials, and similar chemicals and harmful wastes which require special handling and disposal to protect and conserve the environment.

(24) TRANSFER STATION. A transfer station is a solid waste disposal operation used for the loading of solid waste from one vehicle or container to another, generally of larger capacity, prior to transporting to the point of processing or final disposal.

(25) WETLANDS. Wetlands are land areas characterized by surface flooding and/or saturated soils during at least part of the growing season such that only moist soil vegetation or shallow water plants can thrive.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.03 General conditions. All solid waste shall be stored, collected, transported, utilized, processed, and disposed of or reclaimed in a manner consistent with requirements of this chapter. The owner or occupant of any premises, business establishment or industry shall be responsible for the satisfactory storage, collection and transportation of all solid waste accumulated at that premises, business establishment or industry, to a department licensed solid waste disposal operation in accordance with the provisions of this chapter, unless arrangements for such purposes have been made with a collecting and transporting service holding a license from the department.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.04 Solid waste storage. (1) The owner and occupant of any premises, business establishment, or industry shall be responsible for the sanitary, nuisance-free storage of all solid waste accumulated at that premises, business establishment or industry.

(2) Garbage and similar putrescible waste shall be stored in:

(a) Durable, rust resistant, nonabsorbent, watertight, rodent-proof and easily cleanable containers, with close fitting, fly-tight covers and having adequate handles or bails to facilitate handling, or

(b) Other types of containers acceptable to the municipality and conforming to section NR 151.04 (1).

(3) Refuse shall be stored in durable containers or as otherwise provided in this section. Where garbage and similar putrescible waste are stored in combination with nonputrescible refuse, containers for the storage of the mixture shall meet the requirements for garbage containers.

(4) Toxic or hazardous wastes shall be stored in safe locations in separate, closed, containers which are safe for such waste and are identified in accordance with state and federal labeling requirements.

(5) All containers for the storage of solid waste shall be maintained in such a manner as to prevent the creation of a nuisance or menace to public health.

(6) Objects too large or otherwise unsuitable for storage containers shall be stored in a nuisance-free manner.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.05 Licenses. It shall be unlawful for any person to establish, maintain, conduct or operate a solid waste disposal operation, except as provided in sections NR 151.08 (2), NR 151.09 (2), NR

151.11 (1), or NR 151.12 (1), without first obtaining an annual license from the department. The licensing period will begin on October 1 of each year and will terminate on the following September 30. Separate application for an annual license shall be made for each solid waste disposal operation.

(1) Application for initial licensing of a new solid waste disposal operation may be submitted at any time during the licensing year.

(2) A relicensing application shall be submitted to the department by June 1 of each year and shall include a completed application form with the appropriate fee.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.06 Exemptions. A person may apply for exemptions from any of the requirements of this chapter. Before granting exemptions, the department shall take into account such factors as population of the area being served, amounts of waste generated, location of the disposal operation, nature of wastes, seasonal character of the disposal operation, and other significant factors. All exemptions pertaining to a solid waste disposal operation will be granted in writing by the department. Licenses and exemptions shall be reviewed no less frequently than annually, with particular regard to any potential nuisance, hazard to public health and safety, or potential degradation of the environment.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.07 Revocation of a license or exemption. The department may revoke any license or any exemption granted as part of a license if it finds that the solid waste disposal operation is not operated in accordance with the provision of the license.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.08 Solid waste disposal operation—collection and transportation service. (1) A collection and transportation service shall not be established or operated until the service has been licensed by the department.

(2) Licensing shall not be required for persons satisfying the following conditions, but the collection and transportation service shall be operated in conformance with the provisions of section NR 151.08 (5).

(a) Only salvaged materials, mine tailings, gravel pit spoils, quarry material, or similar earth materials are transported.

(b) Only solid wastes from a single household or solid wastes amounting to less than 20 tons per year are transported.

(3) Prior to June 1 of each year completed relicensing applications together with an annual fee of $15 shall be submitted for each collection and transportation service to the appropriate district office. License application for a new collection and transportation service will be accepted at any time. The license fee is not refundable or proratable.

(4) Any person who maintains or operates a collection and transportation service shall maintain and operate the service in conformance with the following practices:

(a) Solid waste shall be transported only to solid waste disposal operations licensed by the department.

(b) Toxic or hazardous waste shall be transported only by services authorized to accept such waste and shall be transported only to disposal operations licensed by the department to accept such waste.

(c) Vehicles or containers used for collection or transportation shall be covered, leakproof, durable, and of easily cleanable construction. These shall be cleaned frequently to prevent nuisances or insect breeding, and shall be maintained in good repair.

(d) Vehicles or containers used for the collection and transportation of any solid waste, including toxic or hazardous waste, shall be loaded and moved in such a manner that the contents will not fall, leak, or spill therefrom, and shall be covered to prevent blowing of material. Where spillage does occur, the collector or transporter shall immediately return spilled material to the vehicle or container, and shall properly clean the area.

(5) When possible, toxic or hazardous wastes shall be neutralized or otherwise made harmless prior to collection and transportation.

(6) The department shall be advised of the expansion of the service to include additional municipalities or termination of any collection and transportation service or any changes in the use of disposal sites 30 days prior to the effective date of such action.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.09 Solid waste disposal operation; transfer station. (1) Solid waste transfer stations will be classified as follows based on their handling, design, capabilities, and use:

Type I—A facility designed and operated to receive solid waste from individual users and from hand unloaded vehicles not exceeding one ton capacity. A solid waste recycling center is considered a type I transfer station.

Type II—A facility designed and operated to receive solid waste primarily from vehicles larger than one ton capacity.

(2) Licensing shall not be required for type I transfer stations, but any person who maintains or operates a type I transfer station or permits use of property for such shall maintain and operate the station in conformance with the following practices.

(a) Containers shall be leakproof and manufactured of rot-proof material. A closeable cover shall not be required unless specifically requested in writing by the department.

(b) Where mechanical equipment is a part of the operation, access shall be limited to those times that attendants are on duty. Access restrictions and/or attendants may be required for a nonmechanical type I facility.

(c) Containers shall be removed or emptied at least once per week and more frequently if conditions warrant.

(d) The transfer station and adjacent area shall be kept clean and free of litter.

(e) No open burning of solid waste shall be conducted.

(f) Effective means shall be provided to control flies, rodents and other insects or vermin.

(g) An all-weather access and parking area shall be provided and maintained.

(3) A type II solid waste transfer station shall not be operated until the station has been licensed by the department.

(4) Prior to June 1 of each year, completed relicensing applications together with an annual fee of $50 shall be submitted for each type II transfer station to the appropriate district office. License ap-

plications for a new transfer station will be accepted at any time. The license is transferable to another station of the license holder, but the fee is not refundable or proratable.

(5) A type II solid waste transfer station shall not be established or altered until a minimum of 2 sets of plans and specifications, prepared and submitted to the department by a registered professional engineer, have been approved in writing by the department. The conditions of this approval are made a part of any license subsequently issued by the department. An initial plan review fee of $75 in addition to the annual license fee shall be submitted for each newly established or previously unlicensed type II transfer station. This fee is not refundable. The plans and specifications shall include the following:

(a) A map or aerial photograph of the area showing the specific location of the transfer station and the land use and zoning within ¼ mile of the station. The map or aerial photograph shall be of sufficient scale to show all homes, industrial buildings, roads, topography and other applicable details. All such details shall be identified and indicated on the map or aerial photograph.

(b) Plot plan of the transfer station including: means of limiting access, such as fencing, gates, natural barriers or other methods; method of screening the station from the surrounding area; general layout of equipment and flow pattern; road access; location of existing and proposed utilities to the transfer station.

(c) Detailed drawings and specifications of all structures, fixed equipment and site.

(d) A report which shall include the following information:

1. Population and area to be served by the station.

2. Anticipated type and quantity of waste to be handled in the station.

3. Types of vehicles used to transport solid waste into and out of the station.

4. Names and locations of all solid waste disposal operations to which waste from the transfer station will be hauled.

5. Persons responsible for the station operations.

6. Methods of treating or disposing of liquid wastes resulting from operation of the transfer station.

7. Appurtenances and procedures intended to: handle heavy or bulky items; store solid waste beyond the end of the working day; control dust, odors, fire, and windblown material; handle solid waste in the case of a major transfer facility breakdown.

8. Methods of volume reduction if used: compacting, grinding, compression or tamping.

9. Daily clean-up procedures.

(6) Any person who maintains or operates a type II transfer station or permits the use of property for such shall maintain and operate the station in conformance with the following practices unless otherwise specified by the department in granting the required license:

(a) A sign, acceptable to the department, shall be posted at the entrance to the operation, which indicates the name, license number, and hours of use of the operation; penalty for nonauthorized use; necessary safety precautions; and any other pertinent information.

(b) A building roofed and enclosed on at least 3 sides or otherwise enclosed to satisfactorily control dust, papers, and other waste materials shall be provided.

(c) Screening shall be provided for a transfer station located within 500 feet of a residence.

(d) The station shall be operated under the close supervision of responsible individuals who are thoroughly familiar with the requirements and the operational procedures of the transfer station.

(e) Access shall be limited to those times that an attendant is on duty.

(f) There shall be no storage of solid waste in the building or yard for a period greater than 24 hours except in conformance with section NR 151.04 or in licensed collection and transportation units.

(g) Unloading of solid waste shall take place only within the enclosed structure and only in approved designated areas.

(h) Solid waste shall be confined to the unloading, loading and handling area.

(i) The transfer station and adjacent area shall be kept clean and free of litter.

(j) Sewage solids or liquids or other toxic or hazardous wastes in quantities detrimental to the normal operation of the transfer station shall be excluded unless plans for special handling have been submitted to the department and approved in writing.

(k) Dust generated by the unloading of solid waste and the operation of the transfer station shall be controlled at all times.

(l) Odor resulting from the unloading of solid waste and the operation of the transfer station shall be controlled at all times.

(m) No open burning of solid waste shall be conducted.

(n) Solid waste which is burning or is at a temperature likely to cause fire or is of a highly flammable or explosive nature shall not be accepted in the transfer station.

(o) Equipment shall be provided to control accidental fires and arrangements made with the local fire protection agency to immediately acquire services when needed.

(p) Means shall be provided to control flies, rodents, and other insects or vermin.

(q) Provision shall be made for the routine operational maintenance of the transfer station and appurtenances.

(r) If for any reason the transfer station is rendered inoperable, an approved alternate method shall be available for solid waste disposal.

(7) Upon termination of the operation of a transfer station, the operator shall notify the department 30 days prior to the termination date and shall submit any further information as deemed necessary by the department.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.10 Solid waste disposal operation—solid waste processing plant. (1) A solid waste processing plant shall not be operated until it has been licensed by the department.

(2) Prior to June 1 of each year completed relicensing applications together with an annual fee of $50 shall be submitted for each solid waste processing plant to the appropriate district office. License applications for a new solid waste processing plant will be accepted at any time. The license is transferable to another plant of the license holder, but the fee is not refundable or proratable.

(3) A solid waste processing plant shall not be established or altered until a minimum of 2 sets of plans and specifications prepared

and submitted to the department by a registered professional engineer have been approved in writing by the department. The conditions of this approval are made a part of any license subsequently issued by the department. An initial plan review fee of $75 in addition to the annual license fee shall be submitted for each newly established or previously unlicensed processing plant. The fee is not refundable. The plans and specifications shall include the following:

(a) A map or aerial photograph of the area showing the specific location of the processing plant and the land use and zoning within ¼ mile of the plant. The map or aerial photograph shall be of sufficient scale to show all homes, industrial buildings, roads, topography and other applicable details. All such details shall be identified and indicated on the map or aerial photograph.

(b) Plot plan of the processing plant including: means of limiting access such as fencing, gates, natural barriers, or other methods; method of screening the plant from the surrounding area; general layout of equipment and flow pattern; road access; location of existing and proposed utilities to the plant.

(c) Detailed drawings and specifications of all structures, equipment and site.

(d) A report which shall include the following information:

1. Population and area to be served by the plant.

2. Anticipated type and quantity of waste to be handled in the plant.

3. Types of vehicles used to transport solid waste into and out of the plant.

4. Names and locations of all solid waste disposal operations to which solid waste from the processing plant will be hauled.

5. Persons responsible for the plant operations.

6. Methods of treating or disposing of any liquid wastes resulting from operation of the processing plant.

7. Appurtenances and procedures intended to: store solid waste beyond the end of the working day; control dust, odors, fire, wind-blown materials; handle refuse in the case of a major processing plant breakdown.

8. Methods of volume reduction or processing—compaction, compression, baling, incineration, shredding, grinding, tamping, separating, classifying or other.

9. Daily clean-up procedures.

(4) Any person who maintains or operates a solid waste processing plant or permits the use of property for such operation shall maintain and operate the plant in conformance with the following practices unless otherwise specified by the department in granting the required license:

(a) A sign, acceptable to the department, shall be posted at the entrance to the operation, which indicates the name, license number, and hours of use of the operation; penalty for nonauthorized use, necessary safety precautions; and any other pertinent information.

(b) Screening shall be provided for any processing plant located within 500 feet of a residence.

(c) Access to the processing plant shall be limited to those times that attendants are on duty.

(d) A processing plant shall be operated under the close supervision of responsible individuals who are thoroughly familiar with the requirements and operational procedures of the plant.

(e) Solid waste except that in the process line shall be stored in conformance with section NR 151.04.

(f) Unloading of solid waste shall take place only in approved, designated areas.

(g) The processing plant and adjacent area shall be kept clean and free of litter.

(h) Sewage solids or liquids or other toxic or hazardous wastes in quantities considered to be detrimental to the normal operation of the processing plant shall be excluded unless plans for special handling have been submitted to the department and approved in writing. This provision does not preclude the right of a processing plant operator to exclude any material as a part of his operational standards.

(i) Dust generated by the unloading of solid waste and the operation of the processing plant shall be controlled.

(j) Odor resulting from the unloading of solid waste and the operation of the processing plant shall be controlled.

(k) No open burning of solid waste shall be conducted.

(l) Solid waste which is burning or is at a temperature likely to cause fire or is of a highly flammable or explosive nature shall not be accepted in the processing plant.

(m) Equipment shall be provided to control accidental fires and arrangements made with the local fire protection agency to immediately acquire services when needed.

(n) Effective means shall be taken to control flies, rodents, and other insects or vermin.

(o) If for any reason the processing plant is rendered inoperable an approved alternate method shall be used for solid waste disposal.

(p) Upon termination of the operation of a solid waste processing plant, the operator shall notify the department 30 days prior to the termination date and shall submit any further information as deemed necessary by the department.

History: Cr. Register, June, 1973, No. 210, eff. 7–1–73.

NR 151.11 Solid waste disposal operation; incinerator. (1) Licensing shall not be required for incinerators having a capacity of 1,000 pounds per hour or less except for incinerators used for the degradation of toxic or hazardous wastes. These incinerators shall be designed and operated in a manner to conform to emission limitations of state and local air pollution control regulations.

(2) An incinerator of capacity greater than 1,000 pounds per hour or for purposes of toxic or hazardous waste reduction shall not be operated until it has been licensed by the department.

(3) Prior to June 1 of each year, completed relicensing applications together with an annual fee of $50 shall be submitted for each incinerator to the appropriate district office. License applications for a new incinerator will be accepted at any time. The license is transferable to another incinerator of the license holder, but the fee is not refundable or proratable.

(4) A solid waste incinerator shall not be established or altered until a minimum of 2 sets of plans and specifications prepared and submitted to the department by a registered professional engineer have been approved in writing by the department. The conditions of this approval are made a part of any license subsequently issued by the department. An initial fee of $75 in addition to the annual license fee shall be submitted for each newly established or previously un-

licensed incinerator. The fee is not refundable. The plans and specifications shall include the following:

(a) Map or aerial photograph of the area showing land use and zoning within ¼ mile of the solid waste disposal site. The map or aerial photograph shall be of sufficient scale to show all homes, industrial buildings, wells, watercourses, dry runs, rock outcroppings, roads, and other applicable details and shall indicate the topography. All such details shall be identified and indicated on the map or aerial photograph.

(b) Plot plan of the incinerator site including: means of limiting access such as fencing, gates, natural barriers, or other methods; method of acceptably screening the facility from the surrounding area; general layout of equipment and flow pattern; road access; location of existing and proposed utilities to the incinerator.

(c) Detailed drawings and specifications of all structures, equipment and site.

(d) A report which includes furnace design criteria and expected performance data, including emission data.

(e) Plans for disposal of incinerator residue and emergency disposal of solid waste in the event of a major incinerator breakdown.

(f) A report which shall include the following information:

1. Population and area to be served by the incinerator.

2. Anticipated type and quantity of waste to be handled in the incinerator.

3. Persons responsible for incinerator operations.

4. Methods of treating or disposing of any liquid wastes or waste waters resulting from operation of the incinerator.

5. Appurtenances and procedures intended to: store refuse beyond end of working day; control dust, odors, fire outside the burning chamber, windblown materials.

6. Other methods of volume reduction—compaction, compression, baling, shredding, grinding, tamping, separating, classifying or other.

7. Daily clean-up procedures.

(5) Any person who maintains or operates an incinerator or permits the use of property for such, shall maintain and operate the incinerator in conformance with the following practices unless otherwise specified by the department in granting the required license.

(a) The incinerator shall be so situated, equipped, operated, and maintained as to minimize interference with other activities in the area.

(b) Adequate shelter and sanitary facilities shall be available for personnel.

(c) A sign, acceptable to the department, shall be posted at the entrance to the operation, which indicates the name, license number, and hours of use of the operation; penalty for nonauthorized use, necessary safety precautions; and any other pertinent information.

(d) All solid waste disposed of at the incinerator shall be confined to the dumping area.

(e) Solid waste except for that in the process line shall be stored in conformance with section NR 151.04.

(f) Facilities shall be provided for dust control in the unloading and charging areas.

(g) The department may require that permanent records be maintained. These records may include, but not be limited to, the weight of material incinerated, the quantity of resulting residue, hours of plant operation, combustion temperatures, and residence time.

(h) Approved fire fighting equipment shall be available in the storage and charging areas and elsewhere as needed.

(i) Arrangements shall be made with the local fire protection agency to provide adequate emergency fire-fighting forces.

(j) Communications shall be provided for emergency purposes.

(k) Adequate equipment shall be provided in the storage and charging areas and elsewhere as needed to allow cleaning after each day of operation or as may be required in order to maintain the plant in a sanitary condition.

(l) The charging openings as well as all equipment throughout the plant shall be provided with adequate safety equipment as prescribed by the department of industry, labor, and human relations

(m) During normal operation, the temperature and residence time in the combustion chambers shall be adequate to fulfill air pollution emission standards, to produce a noncombustible material and to result in an odor-free operation.

(n) The incinerator shall be so designed and operated that it will not cause a nuisance because of the emission of obnoxious odors, gases, contaminants or particulate matter greater than limits established by state and local air pollution control regulations.

(o) Residue shall be disposed of as stipulated in section NR 151.12 or be handled by an alternate method approved by the department.

(p) All waste water from the incinerator shall be discharged into a sanitary sewer or other system approved by the department.

(q) Upon construction of a new incinerator and prior to initial operation, the department shall be notified to allow personnel of the department to inspect the incinerator both prior to and during the performance tests.

(r) Performance tests of the incinerator may be required by the department. A report covering the results of the performance tests in such case shall be prepared by the design engineer of the project and submitted to the department with the copy of all supporting data.

(s) No open burning of solid waste shall be conducted.

(t) If for any reason the incinerator is rendered inoperable an approved alternate method shall be used for solid waste disposal.

(6) Upon termination of the operation of an incinerator, the operator shall notify the department 30 days prior to the termination date and shall submit any further information deemed necessary by the department.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.12 Solid waste disposal operation—land disposal operation. (1) No person shall dispose of any solid waste at any land disposal operation not licensed by the department except for the following operations which are not required to be licensed but which must be operated and maintained in a nuisance-free and aesthetic manner consistent with the intent of this chapter:

(a) Operations used for the disposal of solid waste from a single family or household, a member of which is the owner, occupant or lessee of the property used for solid waste disposal.

(b) A farm on which only agricultural wastes resulting from the operation of the farm are disposed of.

(c) Operations for the exclusive disposal of mine tailings, spoils from gravel or quarry operations, and similar earth material.

(d) Operations at which earth containing less than 25% by volume of concrete, building stone, and asphalt are disposed.

(e) Operations used exclusively for the stabilization and drying of municipal sewage sludge and septic tank sludge.

(f) Operations used for the one time disposal of industrial, agricultural, or demolition solid waste. Although licensing is not required for this type of operation, written approval by the department is required prior to establishment of the operation. The operation shall be established, maintained and operated in accordance with provisions of section NR 151.12 and any other procedures as designated by the department.

(2) A solid waste land disposal operation except as listed under NR 151.12 (1) shall not be operated until it has been licensed by the department.

(3) Prior to June 1 of each year, completed relicensing applications together with an annual fee of $50 shall be submitted for each land disposal operation to the appropriate district office. License applications for a new land disposal operation will be accepted at any time. The license is transferable to another site of the license holder, but the fee is not refundable or proratable. Prior to January 1, 1975 the license holder shall submit to the department a report which shall include a description of method of operation, means for compliance with section NR 151.12 (6), a timetable for achieving the improved operation by October 1, 1975, and a final use plan for the site.

(4) Solid waste land disposal operations are prohibited within the following areas:

(a) Within 1,000 feet of any navigable lake, pond or flowage.

(b) Within 300 feet of a navigable river or stream or to the landward side of the floodplain, whichever is greater.

(c) Within any area from which the department finds that solid waste or leachings therefrom may have a detrimental effect on surface water.

(d) Within an area from which the department finds that leaching from solid waste may have a detrimental effect on groundwater quality.

(e) Within 1,000 feet of the nearest edge of the right-of-way of any state trunk highway or the boundary of any public park unless the site is screened by natural objects, plantings, fences or other appropriate means so as not to be visible from the highway or park.

(f) Within wetland areas.

(5) A land disposal operation shall not be established nor an existing operation expanded until a minimum of 2 sets of plans and specifications, prepared and submitted to the department by a registered professional engineer, have been approved in writing by the department. The conditions of this approval are made a part of any license subsequently issued by the department. An initial plan review fee of $75 in addition to the annual license fee, shall be submitted for each newly established or previously unlicensed land disposal operation. This fee is not refundable. The plans and specifications shall include the following:

(a) Map or aerial photograph of the area showing land use and zoning within ¼-mile of the solid waste land disposal operation. The map or aerial photograph shall be of sufficient scale to show all homes, industrial buildings, wells, watercourses, dry runs, rock outcroppings, roads, and other applicable details. All such details plus the general topography shall be identified and indicated on the map or aerial photograph.

(b) Plot plan of the site showing dimensions, location and ground surface elevation of soil borings, original and proposed final land contours, proposed trenching plan or original fill face, existing and proposed drainage patterns, winter cover stockpiles, access roads, fencing, screening, and any other applicable details. Cross sections shall be included on the plot plan or on separate sheets showing both the original and proposed minimum and maximum fill elevations, thickness and type of underlying soil strata, and groundwater and bedrock elevations. The scale of the plot plan shall be 1 inch equals 200 feet.

(c) An acceptable report on geological formations based on soil borings. The minimum number of borings to be taken is based on site size according to the following schedule:

1. 3 borings for a site of up to 5 acres in size.

2. 1 boring for each additional 5 acres or portion thereof up to 50 acres.

3. 1 boring for each additional 10 acres or portion thereof over 50 acres.

Borings shall be arranged as nearly as possible to form a grid pattern over the site, to provide a subsurface investigation representing the entire site, and to facilitate analysis. When information is insufficient to adequately evaluate the site, additional or deeper borings may be required. All borings shall extend to a depth of at least 15 feet below the lowest proposed elevation of waste disposal in the areas of the borings. Boring holes shall be refilled with a bentonite-earth slurry prior to disposal of solid waste.

(d) A report which shall include the following information:

1. Population and area to be served by the proposed operation.

2. Anticipated type, quantity and source of material to be disposed of at the operation.

3. Source and characteristics of cover material and method of protecting cover material for winter operation.

4. Type and amount of equipment to be provided at the operation for excavating, earth moving, spreading, compaction, and other needs.

5. Persons responsible for actual operation and maintenance of the operation and intended operating procedures.

6. Proposed final use of the completed operation.

(e) The department may require groundwater monitoring wells and water quality sampling and analysis programs, provisions for gas monitoring and sampling, or provisions for protection against possible detrimental effects of leachate and gas production.

(f) The following information is also required for consideration if it is proposed to dispose of toxic or hazardous wastes at a land disposal operation:

1. An indication on the site plot plan of the location of toxic or hazardous waste disposal areas.

2. A plan of operation which includes the following information: disposal and covering frequency; description of signs, gates, fences; methods of waste unloading, emergency fire protection, safety precautions, etc.

3. A list of chemical and trade names of all wastes; names and

addresses of initial sources and transporters; and a report of the average quarterly waste quantities in both pounds and gallons disposed of at the site. Information regarding type and quantity is also necessary for waste deposited on an infrequent or irregular time schedule.

4. The proposed location and depth of a well or wells to be provided at the operation for monitoring groundwater quality.

(6) Any person who maintains or operates a land disposal operation, or permits the use of property for such, shall maintain and operate the operation in conformance with the following practices, unless otherwise specified by the department in granting the required license:

(a) Open burning is prohibited after October 1, 1975. Prior to October 1, 1975, all of the following criteria must be satisfied before the department may grant open burning exemptions:

1. The operation serves a population equivalent less than 2,500. Seasonal variations in population will be considered in the granting of partial yearly burning exemptions.

2. All portions of the licensed operation are greater than ¼ mile from all residences and places of public gathering, or written consent is obtained from all residents and proprietors within ¼ mile.

3. The solid waste open burned shall not include wet combustible rubbish, garbage, oily substances, asphalt, plastic or rubber products.

4. An attendant shall be on duty at all times when open burning is occurring.

5. All open burning shall be accomplished in a nuisance-free manner and without hazard for adjacent properties.

6. Adequate firebreaks shall be provided and maintained and arrangements shall be made to acquire the services of and provide access to the local fire protection agency when its services are needed.

7. Open burning shall not be contrary to any local air pollution control rules.

8. The operation is not located in one or more of the following counties; Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington and Waukesha.

(b) Open burning may be permitted after October 1, 1975 by the department granting an open burning exemption for wood, only after all of the following criteria are satisfied:

1. The operation serves a population equivalent less than 2,500. Seasonal variations in population will be considered in the granting of partial yearly burning exemptions.

2. All portions of the licensed operation are greater than ¼ mile from all residences and places of public gathering or written consent is obtained from all residents and proprietors within ¼ mile.

3. The solid waste open burned shall be limited to wood branches and trunks and the leaves and bark attached to the branches and trunks. The solid waste burned shall not include wood sawdust, wood shavings, wood bark, wood chips, paper, cloth, garbage, plastic and/or other types of solid waste.

4. An attendant shall be on duty at all times when open burning is occurring.

5. All open burning shall be accomplished in a nuisance free manner and without hazard for adjacent properties.

6. Adequate fire breaks shall be provided and maintained and arrangements shall be made to acquire the services of and provide access to the local fire protection agency when its services are needed.

7. Open burning shall not be contrary to local air pollution control rules.

8. The operation is not located in one or more of the following counties: Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha.

9. The area of the operation used for open burning is surrounded with a fence.

10. A minimum distance of 50 yards is maintained between the closest portion of the fence surrounding the area used for open burning and any other portion of the operation used for solid waste disposal.

11. A lockable gate is provided at the entrance to the open burning area and is kept locked except when an attendant is on duty.

(c) No solid waste shall be deposited in such a manner that material or leachings therefrom will have a detrimental effect on any ground or surface water.

(d) Deposition of solid waste shall be confined to as small an area as practical.

(e) The deposition and active area shall be provided with facilities to confine windblown material within that area.

(f) At the conclusion of each day of operation all windblown material shall be collected and returned to the deposition area and shall be buried in accordance with provisions of this section.

(g) Each single layer of solid waste shall be compacted to a depth of approximately 2 feet with no more than 3 compacted layers being placed prior to covering.

(h) Solid waste shall be compacted and covered at the end of each operating day with a compacted layer of 6 inches of soil. All of the criteria in one of the 2 following categories must be satisfied before the department may grant any exemptions for less frequent covering.

1. The operation serves a population equivalent of less than 2,500. Seasonal variations in population will be considered in the granting of yearly or partial yearly covering exemptions.

a. All portions of the licensed operation are greater than ¼ mile from all residences and places of public gathering; or written consent is obtained from all residents and proprietors living within ¼ mile.

b. Solid waste is compacted and covered with at least six inches of earth no less frequently than once per month except for the months of December, January, February, and March.

c. Nuisance conditions are not created.

2. The operation serves a population equivalent of less than 1,000. Seasonal variations in population will be considered in the granting of yearly or partial yearly covering exemptions.

a. All portions of the licensed operation are greater than ½ mile from all residences or places of public gathering; or written consent is obtained from all residents and proprietors living within ½ mile.

b. Solid waste is compacted and covered with at least 6 inches of earth at least 3 times per year (spring, summer, and fall) until October 1, 1975. Thereafter, compaction and covering shall be accomplished in accordance with section NR 151.12 (6) (h) 1.

c. Nuisance conditions are not created.

(i) Surface water drainage shall be diverted away from the working area and off of the landfill operation.

(j) Putrescible materials such as spoiled foods and animal carcasses shall be immediately covered and compacted as prescribed in this section.

(k) Disposal of significant quantities of toxic or hazardous wastes shall be in compliance with provisions of section NR 151.12 (7) or others as specified by the department and only with written approval of the department.

(l) The boundaries of the disposal operation shall be fenced to restrict access and a minimum separating distance of 20 feet shall be maintained between the disposal operation and adjacent property.

(m) Effective means shall be taken to control flies, rodents, and other insects and vermin.

(n) All access roads to the active area of the operation shall be of all-weather construction and shall be maintained in good condition.

(o) Equipment shall be provided to control accidental fires and arrangements shall be made with the local fire protection agency to immediately acquire its services when needed.

(p) An attendant shall be on duty at the operation at all times while it is open for public use.

(q) A gate shall be provided at the entrance to the operation and shall be kept locked when an attendant is not on duty.

(r) A sign, acceptable to the department, shall be posted at the entrance to the operation, which indicates the name, license number, and hours of use of the operation; penalty for nonauthorized use; necessary safety precautions; and any other pertinent information.

(s) The operation shall be surrounded with rapidly growing trees, shrubbery, fence or other appropriate means to screen it from the surrounding area and to provide a windbreak.

(7) Any person who maintains or operates a land disposal operation or permits the use of property for such, for the disposal of material defined as toxic or hazardous waste in section NR 151.02, shall maintain and operate the operation in conformance with the following practices as specified by the department in granting the required license:

(a) The wastes are to be disposed of in the active area of the operation, mixed with the other solid waste, not open burned, and covered with six inches of earth by the end of the day; or

(b) The following operational practices:

1. A separate area shall be designated for the disposal of these materials. A sign shall be posted in the area, indicating its designated use and precautions which shall be taken during disposal.

2. Toxic or hazardous waste materials, containers, and any materials washed from transporting vehicles shall be immediately covered with at least 18 inches of earth prior to compaction. The practice of covering before compacting will minimize the hazard of poisonous fumes which may arise from crushed containers.

3. The operation shall be operated in accordance with all other provisions of section NR 151.12 (6); or

(c) Other practices such as lagooning or evaporation.

(d) The operator shall submit to the department for each calendar quarter a report describing the quantities and types of all toxic or hazardous wastes disposed of at the operation during the previous quarter.

(e) Well(s) shall be provided at the location(s) at the operation specified by the department. The boring log(s) of the well(s) shall be submitted to the department.

(f) Samples of groundwater in the well(s) shall be collected by the operator on a calendar quarter basis and the results of quantitative and qualitative analysis specified by the department shall be submitted by the operator to the department within one month of the collection of each sample.

(8) Any person who maintains or operates a land disposal operation or permits the use of property strictly for the disposal of material defined as noncombustible in section NR 151.02, shall maintain and operate the operation in conformance with the following practices unless otherwise specified by the department in granting the required license:

(a) Only material defined as noncombustible in section NR 151.02 (5) shall be disposed of or stored at the operation.

(b) The material shall be compacted and covered at a frequency to be determined by the department but which shall not be less than once every 180 days.

(c) The operation shall be operated in accordance with all other provisions of section NR 151.12 (6).

(9) Any person who maintains or operates a land disposal operation or permits the use of property strictly for the disposal of solid waste altered by some means at a solid waste processing plant shall maintain and operate the operation in conformance with the following practices unless otherwise specified by the department in granting the required license:

(a) Processed solid waste shall be compacted and covered at a frequency to be determined by the department but which shall not be less than once every 180 days.

(b) Nonprocessed solid waste deposited at an operation used primarily for disposal of processed solid waste shall be compacted and covered after each day of operation with a compacted layer of at least 6 inches of soil.

(c) The operation shall be operated in accordance with all other provisions of section NR 151.12 (6).

(10) Any person who maintains or operates a licensed sanitary landfill or licensed land disposal operation, or who permits use of property for such shall, when the fill area or a portion thereof reaches final grade, or when the department determines that termination is required, terminate and complete the operation in accordance with the following practices:

(a) At least 30 days prior to terminating use of the active disposal operation, the owner or operator of the operation shall notify the department of his intent to cease operations.

(b) Within 15 days after terminating use of the operation, final closure shall be accomplished in the following manner:

1. The entire area previously used for disposal purposes shall be covered with at least 2 feet of compacted earth sloped adequately to allow surface water runoff.

2. The finished surface of the filled area shall be covered with adequate top soil and seeded with native grasses or other suitable vegetation. If necessary, seeded slopes shall be covered with straw or similar material to prevent erosion.

3. Following the termination and completion of a land disposal operation, inspection and maintenance shall be continued by the owner or operator until the fill becomes stabilized.

4. The department may require groundwater monitoring wells and water quality sampling and analysis programs, provisions for gas monitoring and sampling, or provisions for protection against possible detrimental effects of leachate and gas production.

(11) Any person who maintains or operates an unlicensed sanitary landfill or unlicensed land disposal operation, or permits use of property for such shall terminate the operation in accordance with one or both of the following procedures as specified by the department.

(a) That procedure contained in section NR 151.12 (10).

(b) By removing all solid waste disposed of at the operation since the day it became unlicensed.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.13 Solid waste disposal operation; composting operation. (1) A solid waste composting operation shall not be operated until it has been licensed by the department.

(2) Prior to June 1 of each year, completed relicensing applications together with an annual fee of $50 shall be submitted for each composting operation to the appropriate district office. License applications for a new composting operation will be accepted at any time. The license is transferable to another composting operation of the license holder but the fee is not refundable or proratable.

(3) A composting operation shall not be established until a minimum of 2 sets of plans and specifications, prepared and submitted to the department by a registered professional engineer, have been approved in writing by the department. The conditions of this approval are made a part of any license subsequently issued by the department. An initial plan review fee of $75 in addition to the annual license fee shall be submitted for each newly established or previously unlicensed composting operation. The fee is nonrefundable. The plans and specifications shall include the following:

(a) A map or aerial photograph indicating land use and zoning within ¼ mile of the facility. The map or aerial photograph shall be of adequate scale to show all homes, industrial buildings, wells, watercourses, dry runs, rock outcroppings, roads and other applicable details, and shall indicate the topography. All such details shall be identified and indicated on the map or aerial photograph.

(b) Details relating to geological formations of the property whereon the proposed installation is to be located. Such details shall be determined by soil borings or other appropriate means.

(c) An engineering report outlining the proposed method of operation, the quantity and source of material to be processed, the proposed use and distribution of the processed material, and related details.

(d) Additional data as may be required by the department.

(4) Any person who maintains a compost operation or permits the use of property for such shall maintain and operate the operation in conformance with the following practices unless otherwise specified by the department in granting the required license:

(a) The operation shall be conducted in a manner to eliminate public health hazards and nuisances.

(b) A sign, acceptable to the department, shall be posted at the entrance to the operation, which indicates the name, license number, and hours of use of the operation; penalty for nonauthorized use; necessary safety precautions; and any other pertinent information.

(c) Materials resulting from composting or similar processes and offered for sale shall contain no pathogenic organisms, shall not reheat upon standing, shall be innocuous, and shall contain no sharp particles which would cause injury to persons handling the compost.

(d) Byproducts removed during processing shall be handled in a sanitary and nuisance-free manner and shall be disposed of in a licensed solid waste disposal operation.

(5) Upon termination of a composting operation, the operator shall notify the department at least 30 days prior to the termination date and shall submit any further information as deemed necessary by the department.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.14 Solid waste disposal operation; air curtain destructor. (1) An air curtain destructor (ACD) shall not be operated until it has been licensed by the department.

(2) Prior to June 1 of each year, completed relicensing applications together with an annual fee of $50 shall be submitted for each air curtain destructor to the appropriate district office. License applications for a new ACD will be accepted at any time. The license is transferable to another ACD of the license holder but the fee is not refundable or proratable.

(3) An air curtain destructor shall not be established until a minimum of 2 sets of plans and specifications, prepared and submitted to the department by a registered professional engineer, have been approved in writing by the department. The proposed destructor shall comply with all applicable requirements of Wis. Adm. Code chapters NR 154 and NR 155. The conditions of this approval are made a part of any license subsequently issued by the department. An initial plan review fee of $75 in addition to the annual license fee shall be submitted for each newly established or previously unlicensed air curtain destructor. This fee is not refundable. The plans and specifications shall include the following:

(a) Map or aerial photograph of the area showing land use, zoning, homes, industrial buildings, and roads within one-quarter mile of the site.

(b) Plot plan of the air curtain destructor facility showing: means of limiting access; method of screening the facility from the surrounding area; general layout of equipment and flow pattern; access roads; and waste material storage areas.

(c) Construction plans of the burning pit.

(d) Plans and specifications of the blower unit appurtenances.

(e) A report indicating the type and quantity of waste material to be consumed, planned method of charging, startup procedures, safety features to be used at the facility both during and after burning, proposed pit clean-out procedures, and methods to be employed in conforming to the minimum requirements of section NR 151.14 (4).

(4) Any person who maintains or operates an air curtain destructor or permits the use of property for such, shall construct, maintain, and operate the destructor in conformance with the following minimum requirements unless otherwise specified by the department in granting the required license:

(a) The burning pit shall be made of a material which will result in a pit of permanent dimensions. Maintenance shall be performed on the pit to keep its dimensions constant so as to keep the air curtain working properly.

(b) The burning pit floor shall be constructed in a manner which provides proper drainage.

(c) The burning pit shall be oriented perpendicular to the prevailing wind with the plenum chamber and blower on the downwind side.

(d) The charging area shall be paved with a concrete pad for a distance of at least 10 feet from the edge of the burning pit.

(e) Only clean wood wastes and similar combustible materials shall be burned in an ACD.

(f) The main stockpile of waste material shall be kept a minimum of 100 feet from the burner.

(g) Charging shall be conducted in such a manner as to prevent waste material from protruding through the air curtain.

(h) Start-up shall be accomplished by using kindling material to ignite larger materials rather than using fuel oil, flame throwers, tires, or other rubber materials. If no kindling materials are included in the wastes, the burner operators shall obtain a large enough quantity of light-weight wood material to facilitate burner start-up. Where sufficient quantities of kindling material are unobtainable, other approved methods may be used.

(i) Burning shall be conducted only during daylight hours. Quantities of materials to be burned shall be restricted to allow for complete burn out while the site is attended.

(j) Fire fighting equipment shall be kept at the site in case of emergency. Arrangements shall also be made with the local municipality to provide fire protection. Fire breaks shall be provided where necessary.

(k) The burning pit shall be cleaned out on a regular schedule. In no case shall ashes be allowed to accumulate to a depth of greater than 3 feet.

(l) A minimum separating distance of 100 yards shall be maintained between the burner and the nearest residence. In the case of an ACD being located at an existing land disposal operation, a minimum separating distance of 200 feet shall be maintained between the burner and the working face of the land disposal operation.

(m) The burner location shall be screened from the surrounding area.

(n) An ACD shall be surrounded by a fence with a lockable gate. The gate to the burner shall be kept locked when no attendant is on duty.

(o) An attendant shall be on duty at all times when the blower unit is in operation.

(p) Warning signs shall also be posted at intervals around the entire ACD installation notifying people to keep out of the area.

(q) A sign, acceptable to the department shall be posted at the entrance to the operation, which indicates the name, license number, and hours of use of the operation; penalty for nonauthorized use; necessary safety precautions; and any other pertinent information.

(5) Upon termination of an air curtain destructor, the operator shall notify the department 30 days prior to the termination date and shall submit any further information as deemed necessary by the department.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.15 Solid waste disposal operation—salvage yard. (1) A salvage yard shall not be operated until it has been licensed by the department.

(2) Prior to June 1 of each year, completed relicensing applications together with an annual fee of $50 shall be submitted for each salvage yard to the appropriate district office. License applications for a new salvage yard will be accepted at any time. The license is transferable to another salvage yard of the license holder but the fee is not refundable or proratable.

(3) Salvage yards are prohibited within the following areas:

(a) Within 1,000 feet of any navigable lake, pond or flowage.

(b) Within 300 feet of a navigable river or stream or to the landward side of the floodplain, whichever is greater.

(c) Within any area from which the department finds that solid waste or leachings therefrom may have a detrimental effect on surface waters.

(d) Within an area from which the department finds that leaching from solid waste may have a detrimental effect on groundwater quality.

(e) Within 1,000 feet of the nearest edge of the right-of-way of any state trunk highway or the boundary of any public park unless the site is screened by natural objects, plantings, fences or other appropriate means so as not to be visible from the highway or park.

(f) Within wetland areas.

(4) A new salvage yard shall not be established nor shall an existing yard be expanded until a minimum of 2 sets of plans and specifications submitted to the department have been approved in writing by the department. The conditions of this approval are made a part of any license subsequently issued by the department. An initial plan review fee of $75 in addition to the annual license fee shall be submitted for each newly established or previously unlicensed salvage yard operation. This fee is nonrefundable. The plans and specifications shall include the following:

(a) A map or aerial photograph of the area showing land use and zoning within ¼ mile of the salvage yard property. The map or aerial photograph shall be of sufficient scale to show all homes, industrial buildings, roads, watercourses, and other applicable details. All such details plus the topography shall be identified and indicated on the map or aerial photograph.

(b) A plot plan of the site showing dimensions, elevations, proposed layout of operation, access roads, means for limiting access, and method of screening. The scale shall be approximately 200 feet per inch.

(c) A report indicating the following:

1. The type, expected quantity and source of material to be brought to the yard.

2. Present quantity of autos and other materials in inventory.

3. The type and amount of equipment to be provided at the yard for processing purposes.

4. The outlet for the salvaged material and the means of disposal for nonsalvageable items.

5. Persons responsible for actual operation and maintenance of the yard.

6. Operation procedure which details how compliance will be achieved with section NR 151.15 (4).

(5) Any person who maintains or operates a salvage yard or permits the use of property for such, shall maintain and operate the yard in conformance with the following practices unless otherwise specified by the department in granting the required license:

(a) Garbage or similar putrescible material shall not be present at a salvage yard.

(b) No open burning of solid waste shall be conducted.

(c) The yard shall be surrounded by a fence, rapidly growing trees, shrubbery or other appropriate means to screen it where possible from the surrounding area.

(d) A gate shall be provided at the site entrance, to be kept locked when the yard is not open for business.

(e) A sign, acceptable to the department, shall be posted at the entrance to the operation, which indicates the name, license number, and hours of use of the operation; penalty for nonauthorized use, necessary safety precautions; and any other pertinent information.

(f) The operation shall be conducted in an orderly and aesthetic manner.

(g) Any windblown material resulting from operation of the yard shall be collected daily.

(6) Any person, who maintains or operates a salvage yard or who permits use of property for such, when the yard is terminated by the operator or property owner or when the department determines that termination is required, shall terminate the yard by removing all salvageable material within a time period specified by the department, which shall be no greater than 120 days.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.16 Other methods of solid waste handling, processing and disposal. Before any method of solid waste handling, processing and disposal, not otherwise provided for in this chapter, is established, complete plans, specifications, and design data shall be submitted to and be approved in writing by department. The conditions of this approval are made a part of any license subsequently issued by the department. All such information shall be prepared and submitted by a registered professional engineer. An initial plan review fee of $75 in addition to the annual license fee of $50 shall be submitted for each newly established other method of solid waste handling, processing and disposal. Prior to operation of such facility, a solid waste disposal operation license is required.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.17 Limitations. Nothing in these standards shall be construed to limit the provisions of any municipal ordinance, or regulation, which is more restrictive, provided approval of such ordinance or regulation has been approved by the department as required under section 144.44 (2), Wis. Stats.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.18 Severability. Should any section, paragraph, phrase, sentence, or clause of this chapter be declared invalid or unconstitutional for any reason, the remainder of this chapter shall not be affected thereby.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

NR 151.19 Environmental impact. Every application for licensing under this chapter will be reviewed to determine whether department will require the applicant to submit an environmental impact report pursuant to section 23.11 (5) Wis. Stats. or if the department is required to file an environmental impact statement pursuant to section 1.11 Wis. Stats.

History: Cr. Register, June, 1973, No. 210, eff. 7-1-73.

WISCONSIN ADMINISTRATIVE CODE

DEPARTMENT OF LOCAL AFFAIRS AND DEVELOPMENT

Chapter LAD 3

SOLID WASTE MANAGEMENT PLANNING CRITERIA

LAD 3.01 Applicability
LAD 3.02 Procedure
LAD 3.03 Definitions
LAD 3.04 Study of existing conditions
LAD 3.05 Study of alternative approaches for providing solid waste management
LAD 3.06 Conclusions and recommendations
LAD 3.07 Public participation and education

PREAMBLE

An essential part of solid waste management is the development of plans for the establishment and maintenance of effective and efficient solid waste management systems. The purpose of these rules is to provide minimum criteria for the development of county and multi-county solid waste management plans.

LAD 3.01 Applicability. The provisions of this chapter govern the development of county and multi-county plans for organizing, financing and implementing programs to effect the generation, storage, collection, transporting, processing, recycling or final disposal of solid waste in a sanitary, nuisance-free manner in keeping with sections 144.435 and 144.437, Wis. Stats.

History: Cr. Register, April, 1972, No. 196, eff. 5-1-72.

LAD 3.02 Procedure. (1) REVIEW AND APPROVAL. Plans will be approved pursuant to section 144.435, Wis. Stats.

(2) PROCEDURE. (a) A county or counties may submit preliminary plans to the department of local affairs and development for review and comment. Six copies of the final plan shall be forwarded to the department of local affairs and development for review and comment.

(b) Final plans shall be transmitted with a county board resolution requesting that the plans be reviewed and approved by the appropriate departments pursuant to section 144.435, Wis. Stats.

History: Cr. Register, April, 1972, No. 196, eff. 5-1-72.

LAD 3.03 Definitions. For the purpose of these rules:

(1) SOLID WASTE MANAGEMENT. Solid waste management is planning, organizing, financing and implementing programs to effect the generation, storage, collection, transporting, processing, recycling or final disposal of solid wastes in a sanitary, nuisance-free manner.

(2) SOLID WASTE MANAGEMENT PLAN. A solid waste management plan is a plan prepared to provide for solid waste management. Plans shall consist of: studies including evaluations of existing conditions and practices; evaluations of alternatives for improved service; and recommendations for preferred programs and the method whereby they may be implemented.

(3) PLANNING PERIOD. The planning period is the period of time for which the studies and solid waste management plans are made. The minimum planning period shall be 5 years following the date of approval of the plan by the department of natural resources.

(4) DEFINITIONS. The definitions contained in Wis. Adm. Code section NR 151.02 are hereby adopted by reference.

History: Cr. Register, April, 1972, No. 196, eff. 5-1-72.

LAD 3.04 Study of existing conditions. (1) An inventory and analysis shall be made of available data on the physiographic, geologic, hydrologic, soils and the climatic elements as they relate to all elements of a solid waste management system.

(2) An inventory and analysis shall be made of the following factors, including conformance with Wis. Adm. Code chapter NR 151 when applicable:

(a) *Generation, solid waste quantities, sources and characteristics.* Determine solid waste quantities and types from residential, commercial, institutional, industrial and respective seasonal and other variations. Toxic and hazardous wastes and special problem wastes shall be identified as to type, source, characteristics and quantity. Where data is nonexistent or insufficient, estimates shall be made. The basis for any estimates shall be included in the analysis.

(b) *Storage.* Describe storage facilities and practices in the study area. Identify needed improvements and estimate the costs for improvements. Where data is nonexistent or insufficient, estimates shall be made. The basis for any estimates shall be included in the analysis.

(c) *Collection.* Describe the extent of services and costs of collection systems, including but not limited to:

1. Operators and their service areas
2. Population served
3. Frequency of collection
4. Location and number of pickup points
5. Variability of service
6. Service provided commerce and industry
7. Type, amount, condition and life expectancy of equipment
8. Annual cost of collection services

Where data is non existent or insufficient, estimates shall be made. The basis for any estimates shall be included in the analysis.

(d) *Transportation.* Describe the transportation of solid wastes from the ends of collection routes to the disposal site. Include the method of transporting, haul distances, route restrictions and costs.

(e) *Processing.* Describe the extent and costs of the various types of processing operations such as incineration, pulverizing, classifying or other methods employed to facilitate recycling and disposal.

(f) *Recycling.* Describe recycling operations serving the study area including: location, types and quantities of materials handled.

(g) *Disposal sites.* Describe the physical factors and operations of active disposal sites in the study area, including but not limited to:

1. Location (include map)
2. Ownership or leases
3. Areas served
4. Size of site

5. Remaining usable life
6. Potential for site expansion
7. Physical suitability
8. Land costs
9. Operator of site
10. Method of site operation
11. Operational problems
12. Operating restrictions
13. Equipment and personnel used
14. Disposition of special problem wastes
15. Annual cost of operation

Where data is nonexistent or insufficient, estimates shall be made. The basis for any estimates shall be included in the analysis.

History: Cr. Register, April, 1972, No. 196, eff. 5-1-72.

LAD 3.05 Study of alternative approaches for providing solid waste management. An analysis of alternative approaches for solid waste management shall be made, including but not limited to:

(1) CONTINUED OPERATION OF EXISTING SERVICES. Estimates shall be made of the cost of any continued operation of existing services including the improvements required by Wis. Adm. Code chapter NR 151.

(2) PROJECTIONS. Projections shall be made of waste quantities and required land disposal areas during the planning period. Anticipated changes in quantity, location and types of waste generators shall be identified.

(3) LAND USE PLANS. Consideration shall be given to the following factors as they affect the alternative approaches.

(a) Land use plans
(b) Transportation routes
(c) Ordinances, regulations or standards
(d) Future use of completed sites

(4) LAND DISPOSAL SITES. Land disposal sites considered as part of a county solid waste management plan shall be operated as sanitary landfills as defined by Wis. Adm. Code chapter NR 151.

(5) ALTERNATIVES FOR PROVIDING SERVICE. Alternative means for providing storage, collection, transportation, processing, recycling and disposal shall be described in terms of:

(a) Operations
(b) Facilities
(c) Equipment-type, size and amount
(d) Manpower (training and qualifications)
(e) Costs
(f) Environmental impact

History: Cr. Register, April, 1972, No. 196, eff. 5-1-72.

LAD 3.06 Conclusions and recommendations. The plan conclusions and recommendations will serve as a basis for effectuating preferred solid waste management alternatives. The plan shall include but not be limited to:

(1) PREFERRED ALTERNATIVES. Recommendations on preferred alternatives.

(2) ORGANIZATIONAL AND LEGAL MECHANISMS. Organizational mechanisms and ordinances necessary for the implementation of the plan shall be indicated. The future relationship of existing facilities and the mechanism for transition to the recommended solid waste management program shall be enumerated.

(3) FINANCING. The means of financing necessary facilities, equipment and operations between the anticipated cooperating governmental units shall be made explicit.

(4) OPERATIONAL MANAGEMENT. Statements pertaining to solid waste management operations shall include considerations for:

(a) Operational policies and procedures
(b) Priorities and timetable for implementation of the operational system

(5) ANNUAL REVIEW. The plan shall provide for an annual review of the plan and report to the county board or boards. The annual review shall include:

(a) Compliance with local, state and federal regulations
(b) Coordination with other county or regional plans
(c) Progress in implementing operational program
(d) Updating and revision to the original plan
(e) Summary of annual costs and services
(f) Evaluation of progress toward specific goals and objectives

History: Cr. Register, April, 1972, No. 196, eff. 5-1-72.

LAD 3.07 Public participation and education. The plan shall indicate public participation and educational efforts.

(1) Participation may be through an advisory group developed to guide preparation of the plan, stimulate citizen interest in solid waste issues and help the planning organization and local government implement the recommendations of the plan. Organization of the advisory group shall include a representative cross section of the county or counties.

(2) Public education programs for interest groups and individuals shall provide factual information, define issues and alternatives and encourage public discussion and support for efficient solid waste management systems. Education programs shall be designed for schools, television, newspapers, youth groups, civic clubs and other community based organizations.

History: Cr. Register, April, 1972, No. 196, eff. 5-1-72.

APPENDIX C

WISCONSIN SOLID WASTE RECYCLING
An Executive Summary of the Predesign Report

BACKGROUND FOR ASSEMBLY BILL 922

WSWR

Prepared by the Board of Engineering Consultants
in cooperation with
The Governor's Recycling Task Force on Solid Wastes

May 1973

BACKGROUND

In 1971 the Governor charged his Recycling Task Force on Solid Wastes to prepare a plan for an all inclusive center to recycle all types of solid waste. Funds for Task Force work were provided by the Board on Government Operations (BOGO). The Task Force concluded that recycling is feasible in Wisconsin; and recommended that:

1. The State fund a preliminary engineering report to be completed within one year of date of beginning.
2. Following completion of the preliminary engineering report, a state-wide authority be created to carry the recommended projects to fruition.

Pursuant to the Task Force recommendations an appropriation of $200,000 was made by BOGO for preparation of a preliminary engineering report providing the information needed for engineering plans, and making recommendations for organizing, financing, and operating recycling facilities.

A three man Board of Engineering Consultants (Board) was appointed to prepare the report. As part of its investigation the Board examined markets and recycling costs for facilities handling 300 tons per day (for example Wausau and Eau Claire areas); 600 tons per day (Madison and Green Bay); and 1,200 tons per day (Milwaukee and Appleton-Fond du Lac areas). Following is a summary of the Board's report.

NEED FOR RECYCLING

Recycling is urgently needed because:

1. Disposal costs are increasing and sites are more difficult to obtain.
2. Recycling will reduce the number of sites and land needed for disposal.
3. Waste quantities are rapidly increasing.
4. Recycling will reduce present disposal costs, and provide future return.
5. Markets exist for some recycled materials and others are developing.
6. Natural resources and energy can be conserved.
7. The air, water, and soil environment will be better protected and improved.
8. Citizens desire and demand it.
9. Recycling will result in new and accelerated industrial development.
10. Recycling will result in additional employment, and expanded tax base.

Increasing waste quantities are caused by increasing population, economic affluence, short life-product design, higher repair costs and more convenience packaging. Present and future waste quantities for the entire State are estimated as:

1. 12,150 tons per day in 1973.
2. 12,825 tons per day in 1975.
3. 17,200 tons per day in 1985.

State-wide disposal costs will rise from $16,300,000 in 1971 to an estimated $39,000,000 in 1980 if recycling does not occur.

RECOMMENDATIONS

In keeping with its charge, the Board recommends, as did the Task Force, that a state-wide Authority be created that will provide an immediate and long term program for economical recycling. Implementing state-wide recycling now requires an authority which can:

1. Initiate immediate recycling programs for newspapers, corrugated board, appliances, junk automobiles, and tires.
2. Provide large volumes of wastes required for economical recycling in both urban and rural regions.
3. Assure continuous, reliable supply of reclaimed waste.
4. Make long term financial and contractual commitments required to secure industrial interest.
5. Provide economical financing.
6. Aggressively develop markets.
7. Receive wastes from established municipal and private collection services.
8. Involve private enterprise to the fullest extent beginning at the earliest point in the system. Contract services of the existing secondary materials industries can be used.
9. Make reimbursement for local public systems incorporated into recycling programs.
10. Make in-lieu-of-tax payments for facilities removed from local tax rolls.

Such an Authority with responsibility for state-wide recycling will need commensurate powers to plan, design, acquire land, finance, construct, operate, maintain, and make contractual arrangements necessary to transfer, transport, process, reclaim, market, and dispose of solid waste. Making maximum use of private enterprise should enable the Authority to be kept small in size.

The recommended Authority would not:

1. Establish dumping fees without approval of the Public Service Commission or other independent agency.
2. Interfere with established secondary materials industries.
3. Set standards for landfill performance or enforce them.
4. Levy taxes.
5. Interfere with local or private waste collection.

PROGRAM DEVELOPMENT

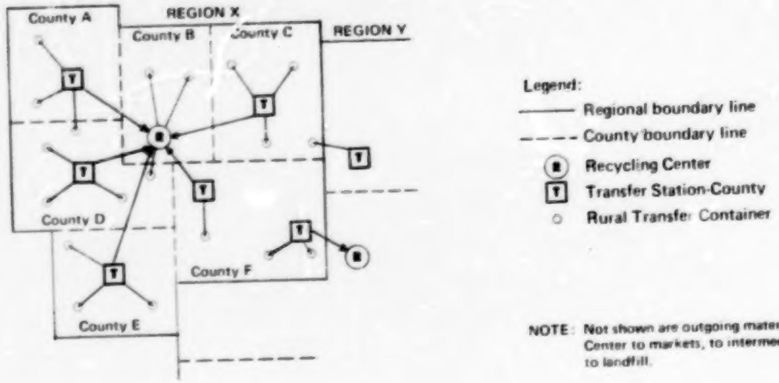
The recycling program should be initiated in one rural region, and two urban regions. Recycling in additional regions will follow based on need, economics, and markets.

Figure 1 diagrams a recycling system in a more rural area in which locally collected wastes are delivered to county transfer stations, for transport to regional recycling centers or disposal sites. Filled containers are loaded onto a truck and taken to a transfer station (T in Figure 1). Wastes can then be transported to regional recycling centers or disposal sites.

Such a program of rural collection and regional or county-wide sanitary landfill is amenable to economical operation by private contractors. This rural system will demonstrate to other regions the type and costs of an operating system which can be adapted for their benefit. Providing recycling services to rural areas can relieve them of the increasingly difficult burden of complying with standards and curtailing costs.

FIGURE 1

Typical Regional System Serving Several Counties



NOTE: Not shown are outgoing materials from Recycling Center to markets, to intermediate processors, and to landfill.

The recycling system will eventually be financially self-supporting. Seed money from the State revolving fund will be needed to conduct the initial recycling operation while a revenue bond system is developed to make the system self-supporting. Revenue bonds will avoid the use of tax money; and will be repaid by revenue from recycled wastes and dumping fees. The seed money required is:

Purpose		Amount and Source
Authority Operation-1973-1975 Biennium	---	$700,000 from General Purpose Revenue
Transfer Station, Recycling Centers, and Disposal Sites in 3 regions.	---	$17,000,000 from State Building Program Revolving Fund, and Bonding.

Total capital costs of a state-wide program are estimated to be on the order of $120,000,000 in terms of 1973 dollars, to be expended over a period of 10 years or less.

Dumping fees will be required to service the revenue bonds. Full realization of the potential for recycling will require participation of communities as markets develop, existing sites become filled, and recycling facilities become available. Programs and decisions of the Authority will be subject to review and approval by the Department of Natural Resources, Public Service Commission, Courts, and other appropriate authorities. The relationship of Authority recycling activities to established services is shown in Figure 2.

LEGISLATIVE RECOMMENDATIONS

Based on legislative concepts suggested by the Board, Assembly Bill 922 was introduced into the Wisconsin Legislature for hearings this session. Through a joint legislative effort a substitute amendment is being developed in time for hearing.

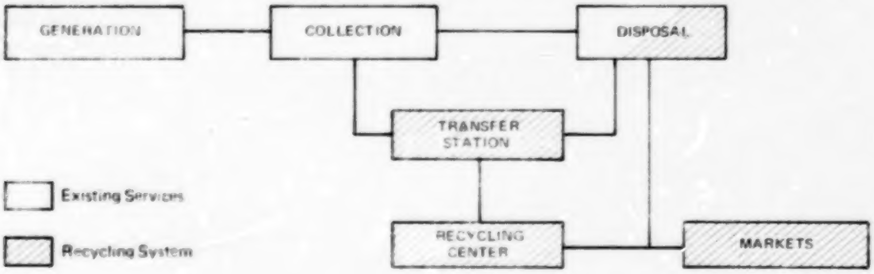
Because of the mounting problem it is critical that legislation be enacted which:

1. Creates a Wisconsin Solid Waste Recycling Authority.
2. Appropriates funds to initiate operation of the authority.

Once established, the authority can select its executive director and begin implementating a state-wide program of solid waste recycling.

Early enactment of the above legislation is imperative because:

1. Communities are faced with making independent decisions on current problems, and are seeking help.
2. Communities are investing in facilities which may later deter regional recycling.
3. Communities are encountering a developing monopoly on local sites which if continued will result in higher disposal rates and taxes.
4. Time is required for implementation of programs.
5. Industry is currently making commitments on equipment and raw materials which may eliminate them as a potential market.
6. There is advantage in early participation in new markets.
7. Early recycling takes advantage of current fixed capital costs, added revenue from recycled products and expanding markets.


GENERATION
COLLECTION
DISPOSAL
TRANSFER STATION
Existing Services
Recycling System
RECYCLING CENTER
MARKETS

Relationship of Recycling System to Existing Services

FIGURE 2

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